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ABSTRACTS

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&
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Forward

It gives me a great pleasure for being coordinator of Undergraduate Research Forum 2016 and editor for compilation of abstracts (Volume 8) of Undergraduate Research Forum 2016 of Faculty of Agriculture, Eastern University, Sri Lanka.

The forum is annually organized by the faculty to present the research findings of the students who have finished their research component in Fourth Year Second Semester of the degree programme. Undergraduate Research Forum 2016 was held from 14th to 15th March 2016 at the Faculty of Agriculture, Eastern University, Sri Lanka. There were 64 research presentations presented from the field of Agricultural Biology, Agricultural Chemistry, Agricultural Economics, Agricultural Engineering, Animal Science and Crop Science. This volume (*vol. 8*) bears the abstracts of all 64 research projects presented by students in the forum.

I express my gratitude to Dr. P. Sivarajah, Dean/Faculty of Agriculture for gave me the opportunity and for his enormous cooperation in compiling this volume successfully. I extend my sincere thanks to all academic staff members of the faculty who had guided and supervised the research students in a right path, and the examiners who evaluated the research projects. I also wish to thank all Heads of the Departments of the Faculty of Agriculture for their fullest support to compile this volume. Finally I thank all the students who presented their project in the sessions, Assistant Registrar of the Faculty and non-academic staff members who helped to conduct Undergraduate Research Forum 2016 successfully.

Mr. M.S. Mohamed Nafees
Coordinator and Editor/Undergraduate Research Forum 2016
Faculty of Agriculture

Message from the Dean

I have great pleasure in sending this message of felicitation on the publication of the Undergraduate Research Forum 2016 – Abstracts of the Faculty of Agriculture.

This brings out the research findings of the Research Project work done by the Final Year students of the Faculty of Agriculture. The information contained in the booklet would be useful to future research students, academic staff and others working in government institutions.

I congratulate the students involved in the research work conducted and their supervisors for the excellent work done.

I would also like to appreciate and thank the Editor of this publication Mr. M.S. Mohamed Nafees for his patient and tiring efforts in producing this document.

I hope this endeavor will be continued by students and staff involved.

Dr. P. Sivarajah
Dean/Faculty of Agriculture

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Characterization of different chilli (*Capsicum annuum* L.) lines and varieties against temperature stress

A.I.K. Abeysekara

Chilli is an important cash crop in Sri Lanka. Currently chilli production is lower than the requirement. Although as one of the most prominent consequences, global mean air temperature is projected to increase by 2.4 to 6.4 ^{0}C at the end of this century. Therefore introduction of temperature tolerant chilli varieties is important for the future cultivation. Therefore a field study was conducted at the Field Crops Research and Development Institute, Maha Illuppallama during October 2015 to January 2016 to examine the yield response and screening of chilli varieties against temperature stress. Different chilli varieties and lines (Michhy 1, Waraniya, Galkiriygama, KA 2, MI Green, line Michpl 1 and Mich3) were used as treatments. All management practices were given similarly for all treatments. High temperature significantly affected the treatments and their growth such as plant height, number of branches, number of leaves, canopy width as well as physiological characters such as chlorophyll content, leaf area, photosynthetic rate, pollen viability, number of pods per plant, pod length, pod diameter, dry matter content of different chilli varieties and yield. Growth, physiological and yield parameters were affected and reduced the annual production. Yield reduction was 44% for the variety Michhy 1, around 63% in the variety "Waraniya" around 87% in variety "Galkiriyagama". However, the yield reduction among other treatments was not significantly different. Therefore, it was concluded that the yield of chilli (*Capsicum annuum* L.) variety "Galkiriyagama" was negatively correlated with temperature stress and variety "Michhy 1" showed the highest yield in the presence of high temperature.

Supervised By: Dr. S Mahendran
Senior Lecturer Gr.I, Dept. of Agric. Biology

Effects of different levels of salt stress on the growth and yield of cowpea cultivar "Waruni" (*Vigna unguiculata* L. Walp.)

G.A. Mahesh Sushantha

Salinity is an important agricultural problem which decreases or restricts crop production both globally as well as in Sri Lanka. Cowpea (*Vigna unguiculata* L. Walp.) is well adapted in different environmental conditions and could be used as an alternative crop for salt affected soils.The present experiment was aimed to evaluate the effects of different levels of salt stress on the growth and yield of cowpea cultivar 'Waruni' at different growth stages. This experiment was conducted at the Agronomy farm of the Eastern University, Sri Lanka from October 2015 to January 2016. The experiment was laid out in the Completely Randomized Design which consisted of six treatments and four replications. The treatments consisted with same potting media such as top soil: red soil: compost at a ratio of 1: 1: 1. Cowpea seedlings were subjected to salt stress by the application of different levels of NaCl solution (100 mM, 200 mM, 300 mM, 400 mM and 500 mM NaCl solution) at three days interval. Twelve plants from each treatment were evaluated for the selected characters such as plant height, leaf area, stem dry weight, leaf dry weight, shoot dry weight, root dry weight, number of pods per plant, number of seeds per pod, hundred seed weight, pod girth, pod length, root dry weight, chlorophyl "a" and "b," total chlorophyll, leaf water content and yield. All the tested attributes of cowpea cultivar 'Waruni' were significantly affected by different levels of salt stress. Among the treatments, the highest results were found in treatment 3 which was 2oo mM of salinity on plant height, leaf area, stem dry weight, number of seeds per pod, hundred seed weight, pod girth, pod length and yield. The lowest values were observed in 500 mM salinity. The highest yield of 1794.5 kg ha^{-1} was recorded in T_3 treatment whereas the lowest one (833.1kg ha^{-1}) was found in T_6 treatment. From these results it was found that the effects of different levels of salt stress on the growth and yield of cowpea cultivar "Waruni" during different growth stages had been remarkable. Concentrations of different levels of salinity above 200 mM drastically reduced the pod production and yield.

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Effects of growth hormones on the auxiliary bud initiation and shoot development of cordyline plants (*Cordyline fruticosa*)

P.S. Palugaswewa

Cordyline is a major foliage plant species in the tropical and sub-tropical countries and economically important genera in the family *Asparagaceae*. Thus, availability of quality planting material becomes a major problem in cordyline cultivation. Therefore, this study was carried out to induce lateral shoot formation of detopped cordyline with Cytokinin (BAP) and Cytokinin + Auxin (BAP+NAA) combination. A length of 25 cm shoots were potted in 20cm height and 20 cm width Polyethylene bags containing compost and sand at a ratio of 1:1. Plants were kept for three weeks in the shade before decapitation. Application of different concentrations of BAP (25 ppm, 50 ppm and 75 ppm) was done for the first time and after that application of different concentrations of NAA (25 ppm, 50 ppm and 75 ppm) was done in combination with a constant level of BAP (75 ppm) at one week interval. Number of lateral shoots, length of lateral shoots and number of leaves were recorded after the hormone treatments at one week interval. Application of 75 ppm cytokinin (BAP) was considered as the most effective treatment to induce lateral shoot formation as well as to improve growth performance in cordyline plants. Among the different treatments tested, 75 ppm BAP has given the highest number of lateral shoots and leaves compared to the other treatments. Length of shoots per plant did not increase remarkably due to the application of hormones. The findings of this study clearly revealed that 75 ppm BAP performed better than the other concentrations of BAP. Combination of NAA+BAP showed notable effects on the number of shoots, length of shoots and number of leaves in cordyline plants. During the study period there was some fluoride toxicity and it was trying to damage the terminal growing point of cordyline plants. Furthermore, this study could be extended to induce auxiliary bud formation in foliage cordyline plants as well.

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Comparison of Walkley and Black method with loss of ignition to determine soil organic Carbon contents in soils of Badulla district

Tharanga Niroshani Rajapaksha

Organic Carbon was tests based on the Walkely-Black method by using Dichromate as one of the reagents. Dichromates are Highly Toxic and Carcinogens which pose a serious risk to health. There has been an increase in the number of accidents involving this substance, mainly due to the large number of samples requiring testing, and therefore the large number of flasks which are having to be manipulated. The test uses relatively large amounts of Dichromate and therefore produces large amounts of waste Dichromate which is becoming increasingly expensive to dispose of. The Health and Safety risk to laboratory personnel has been a key driver in re-examining the standard organic matter method. Walkey and Black method of measuring soil organic carbon (SOC) are not adequate for accurate evaluation of C holding or to meet environmental safety requirements. Therefore required the method accurate assessment of SOC. which are environmentally healthy, and yet feasible for use in developing countries are needed. Therefore a comparison of Loss on Ignition (LOI) and Walkley and Black methods was carried out with soils of Badulla District, SOC ranging from 0.57 – 10.9 g kg^{-1}. The regression equation is LOI = 1.713 + 2.551 W&B and (Adj) R^2 value is 0.622(n =143). Pearson correlation of LOI and W&B = 0.789. (p - Value>0.001).these two methods had good correlation as expected. Therefore LOI can be used as alternative method to the W&B method to calculate Soil Organic Carbon in Badulla District soil.

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Development of Mixed Fruit Leather using Five Tropical Fruits

D.B.G. Madusanka

Fruits are universally promoted as healthy foods, diverge greatly in content of energy and nutrients and usually consumed in the form of raw or processed. Fruit leathers are dehydrated sheets of fruit purees or a mixture of fruit juice concentrate and other ingredients with high nutritive value and organoleptic properties. The mixed fruit leathers were produced from purees of five tropical fruits namely mango, pineapple, banana, papaya and passion. The fresh fruits were pureed and they were mixed with other ingredients such as sugar and pectin and then dried in a cabinet air dryer at 60°C for 12-14 hours. All fruits were mixed in the same proportion while different sugar levels such as no sugar, 10%, 20% and 30% used as treatments. The physico-chemical, microbial load and organoleptic properties of the prepared fruit leather samples were evaluated in all treatments during the storage period of 4 weeks. The moisture contents (22%) were low and the titratable acidity (0.5% citric acid) and pH (3.8) were low immediately after preparation of fruit leather and after 4 weeks of storage pH (3.9) was slightly increased. TSS of the product was initially was mean 56.7°Brix and during the storage and it was increased to 60.1°Brix. Sensory analysis was carried out using 20 trained panelists to evaluate the colour, taste, mouth feel and overall acceptability of the developed fruit leathers using a 7-point hedonic scale. Based on sensory analysis, the fruit leather produced with 20% sugar showed the best organoleptic characteristics. The produced leather could be used to replace fresh fruits and 36g is equivalent to 200g of fresh fruits. It is very much convenient to consume 36g of fruit leather to fulfill the fresh fruit recommended requirement of 200g per day.

Supervised By: Prof. (Mrs). Thevaki Mahendran
Professor in Agricultural Chemistry

Effect of different levels of potassium on growth and yield of mung bean

W.S.A. Wickramasinghe

Green gram is one of the important grain legumes which can be successfully grown in dry and intermediate zones with low moisture condition. Several studies revealed that low availability of nutrients in the soil affect adversely on growth and yield on mung bean. This study evaluated the effects of different levels of potassium on growth and yield of mung bean (variety MI 6) during the *Maha* 2015/ 2016 at Field Crops Research and Development Institute, Mahailluppallama. There were nine treatments such as No fertilizer, 9kg/ha (basal) + 6kg/ha (topdressing), 4.5kg/ha(basal) + 10.kg/ha (top dressing), 18kg/ha(basal) + 12kg/ha(top dressing), 9kg/ha(basal) + 21kg/ha(topdressing), 27kg/ha(basal) + 18kg/ha(topdressing), 13.5kg/ha(basal) + 31.5kg/ha(topdressing), 36kg/ha(basal) + 24kg/ha(top dressing), 18kg/ha(basal) + 42kg/ha(topdressing).Pot experiment was performed in Complete Randomized Design with four replicates and results were analyzed using ANOVA in SAS statistical package. The results revealed that potassium is important for better growth and yield of mung bean. And 15kg K /ha is recommended to get higher yield and there was no change in the yield and yield attributes by increasing the rate of potassium on mung bean.

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Effect of Gypsum and Organic amendments on Nitrogen and Phosphorous leaching in Sandy Soil

V. Vinojini

Nitrogen and Phosphorus are the essential nutrients that required for the sustainable crop production. The loss of N and P by leaching is an important issue, especially on agricultural fields. Nutrient retention capacity is important to maintain soil with high fertility. A column experiment was conducted in sandy soil to study the effect of gypsum and cow dung on the movement of Nitrate, Ammonium and Phosphate in infiltrated water. Eighteen undisturbed soil columns (PVC tubes) with the dimension of 30 cm height and 5.4 cm diameter were hand excavated in the experimental site. All treatments and control were incubated with ammonium nitrate at the rate of 50 Kg/ha and TSP at 100 Kg/ha for two weeks. Amendments such as cow dung was applied at the rate of 10tons/ha and gypsum was applied at the rate of 5 tons/ha. The treatments were (1) control, (2) sole gypsum, (3) sole cow dung, (4) cow dung amended with 75% gypsum, (5) cow dung amended with 50% gypsum and (6) cow dung amended with 25% gypsum. Treatments were arranged in a Completely Randomize Design (CRD). Four leachate fractions were collected by applying four pore volumes of water. Results showed that combine treatments reduced the nitrate and phosphorous leaching. Among the treatments cow dung + 25% gypsum leached least amount of nitrate (40.64 mg/L) and cow dung + 50% gypsum leached least amount of phosphorous (5.481 mg/L). Sole cow dung treatment minimized the ammonium leaching and found to best in nitrate retention. Sole application of gypsum superior in retained ammonium (88.12mg/kg). The overall practical conclusion of this study is that to control N and P transport, it is necessary to apply cow dung and gypsum to the soil.

Supervised By: Mrs. K. Prapagar
Senior Lecturer Gr.II, Dept. of Agric. Chemistry

Influence of Different Storage Temperatures on the Wheat Flour Quality Parameters during Short-term Storage

J. Sujitha

Wheat flour is the milled product of wheat grain, can be produced to fulfill different purposes such as cakes, bread, string hoppers, muffins, rotti etc. by altering their chemical compositions. Three differently produce wheat flour samples with different chemical compositions, freshly milled in Prima Ceylon Private Ltd, Chinabay, Trincomalee were stored for 3 months from under different storage temperature conditions of room temperature 30±1°C and air conditioned storage of 5±1°C. The quality characteristics such as moisture, wet gluten, gluten index, ash, protein, color value and falling number and microbiological characteristics, weevils count, bacterial count, yeast and *E.coli* counts of three different flour samples were determined at regular intervals of 2 weeks. Flour moisture, protein content, ash content, color value and falling number changed with the time of storage under two different storage temperatures but no explicit influence of the storehouse conditions and the initial flour properties was proved. Visco-elastic properties of wet gluten and gluten index of weaker flour samples changed during storage more markedly than those of stronger flour in the sense of a significant improvement of their quality. Biological and microbiological characteristics were influenced by storage temperature since the water activity was the main factor influencing their survival. It was observed that the flour maturation is more prominently happened in the samples stored under room temperature conditions than air conditioned room storage. This made that clear that temperature plays a significant role in flour maturation and it is the main factor controlling the wheat flour quality parameters during storage. Among the quality parameters, moisture, wet gluten gluten index and falling number are the most important parameters which changed significantly due to flour maturation process.

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Nutritional survey among the pre-school children aged between 3-5 years in the Mahiyanganaya DS Division

M.R. Dumindha

The nutritional status of the students at school should be adequate to produce well educated, skillful persons to drive our country in the correct way for a bright future. Therefore, it is essential to assess the nutritional status of pre-school community and among to take care in order to improve their nutritional level. As such, Nutritional Survey was carried out among the Pre School children aged between 3-5 years in the Mahiyanganaya DS Division which is in the Badulla District of Uva Province. 150 Pre School children were selected as samples from the randomly selected school, age of between 3-5 years were stratified based on their age and gender. According to the data collected in the study area, 56% of children are in severe malnutrition (BMI < 14) and 25.3% (BMI: 14 – 16.5) are in moderate malnutrition and only 17.3% (BMI: 16.5 – 20) are in ideal condition and 1.3% (BMI > 20) are in the category of over nutrition. Percentage of Stunting in Mahiyanganaya DS Division Z score -2 SD to +2 SD - Normal condition 30.5%, Z score < -2SD- Stunted 37.3%, Z score < -3 SD – Severely Stunted 16.9%. Percentage of Wasting is significantly high and distributed throughout all age and also it is not specific for a particular age limit. The percentage of wasting students can be displayed as follow: Z score -2 SD to + 2SD – Normal condition 30%, Z score < -2 SD – Wasted 58%, Z score < -3 SD – Severely wasted 12%, Mid Upper Arm Circumference: 10.1 % children's MUAC is > 25 cm, the BMI is likely to be > 20 , 13.3 % Children's MUAC is > 23.5 cm & < 25cm, the BMI is likely to be—> 18.5 and <20 and 76.6 % Children's MUAC is <23.5 cm, the BMI may be < 18.5. Dietary Analysis - Frequency of Food Intake. It was assessed how often the children receive foods such as starches (rice, maize, bread and potatoes), pulses (dhal. soya beans, meat. egg. and fish) vegetable and fruits. The means consume food items such as bread, rice, green, vegetable daily. According to these patterns only 12.5% students had got the sufficient amount of calorie value in a day and 80.8% students had not got. According to the information gathered their staple food was rice but at the same time the meal taken was not a balanced one. Following Socio- Economic Factors were identified: Family Income, Food consumption Pattern, Educational Level, Family Size, Sanitary Practices, Infectious diseases. When considering the Family income, Food consumption pattern, educational level, family size, Sanitation practices and infectious diseases, family size and infectious diseases were higher and all the other factors were lower in the study area.

It can be concluded that, the above conditions have contributed to the malnutrition of the preschool children in the study area. The relationships of above factors with the Nutritional Status of Pre School Children in the study area were found as follows.

- There is a positive correlation between food consumption and body mass index.
- There is a positive correlation between Monthly family income and body mass index.
- There is a negative correlation between family sire and body mass index.

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Nitrogen release patterns of urea and nano urea fertilizer under two contrasting soil moisture regimes

K.M.C. Dharmasena

Nitrogen is one of the key fertilizer input used by the farmers today. Nitrogen release from different N sources depends on the soil environment. Fertilizer material which showing slow N release could be useful to increase the efficiency of the inputs while minimizing the environmental contaminations. Therefore, this laboratory incubation study was designed to evaluate the nitrogen release pattern of the nano fertilizer and compared with that of a commercial fertilizer urea in Reddish Brown Latosol (RBL) under submerged and upland moisture regimes. Treatments were replicated five times and the incubation was end after two weeks for short term experiment and ten weeks for long term experiment. Differential N release kinetics of the nano urea (NU) and urea (U) were determined by measuring ammonium-N and nitrate-N contents at 2 days interval for short term experiment and two weeks for long term experiment. Net N released, as a percentage of available N, was greater in the urea (65-73%) and nano urea scored respectively a low value (40%) under upland moisture condition 98% and 71% under submerged moisture regime in the short term incubation. At the end of tenth week 10% of applied N was remained in urea applied soil and 35% of applied nitrogen was observed in nano urea (NU) treated soil. The results indicate that nano urea shows slow release pattern of nitrogen in both submerged and upland moisture regime in RBL.

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Production of Ready-to-cook Dehydrated Vegetable Mixture

D.G.C.A. Bandara

The dehydrated vegetables are used to manufacture instant vegetable noodles, soups, snacks and fast food. A study was conducted to develop ready-to-cook dehydrated vegetable mixture using locally available different vegetables. Pumpkin, carrot, brinjal, cabbage and green bean were used to produce dehydrated vegetable mixture using different levels of pumpkin which served binding properly to the mixture. The fresh vegetables were peeled, steamed and blended into a puree and spread on a tray and was dehydrated in a vacuum dryer at 55±2°C for 13-14 hours. Different vegetable mixtures were produced by changing the level of pumpkin added while keeping other ingredients as constant. The physico-chemical properties, sensory evaluation and microbiological studies of the dried leathers were carried out for all the four treatments which were arranged in completely randomized design. Based on physico-chemical and sensory properties the treatment with 1.2 of pumpkin was selected as the best combination compared to other treatments. The product was of having 22% moisture and can be kept microbiologically safe for 5 weeks at ambient temperature of 30±1°C. The product was safe from microbial counts. Sensory evaluation revealed that the product could be consumed with high overall acceptability. This product can be used to replace the recommendation of daily consumption level of 200g of fresh vegetables from five different types by consuming 17g of the dehydrated vegetable mixture per day. Preparation is convenient and the same level of nutrition will be provided and the palatability is increased by formulating the dehydrated vegetable mixtures for the people.

Supervised By: Prof. (Mrs). Thevaki Mahendran
Professor in Agricultural Chemistry

Study on preparation and storage of composite vegetable squash of tomato, pumpkin and ginger

Ruvini Gayanthika Lakmali

In the present world, production and consumption of fruit and vegetable beverages have increased owing to the healthy life style of the people. Therefore, a study was conducted to develop composite vegetable squash by incorporating nutritional, medicinal and organoleptic properties of tomato, pumpkin and ginger. Considering the finding of several preliminary studies, five formulations in different combinations of tomato and pumpkin were taken and their physico-chemical parameters such as pH, TSS, titrable acidity, ascorbic acid content and total sugar and organoleptic parameters such as colour, aroma, taste, nature, overall acceptability were analyzed. Then the best sample was improved by using 1 % ginger (50% tomato+ 50% pumpkin+ 1% ginger). Best three formulations were selected for storage studied. The formulations were stored at 30C^{O} room temperature and 70-75% of RH for 12 weeks. Physic-chemical parameters ,organoleptic and microbial activity (total plate count, yeast and mold, E-coil) were analyzed during storage periods and protein content, fat content, ash were also analysed %. The study on comparison of physico-chemical and sensory qualities of stored Squashes was done up to 12 weeks storage periods. The nutritional analysis of freshly prepared tomato pumpkin veggi squash formulations showed increasing trend in tritrable acidity, pH, total sugar, non -reducing sugar, total soluble solids and decreasing trend in ascorbic acid and reducing sugar with storage periods. The results of chemical analyzis showed that, there were significant differences ($p<0.05$) between tested formulations. Sensory analyzsis also showed that there were significant differences ($p<0.05$) for organoleptic characters between squash formulations. The highest overall acceptability was observed in formulation with 50% tomato+ 50% pumpkin+1% ginger and all the all the formulations were microbiologically safe for consumption. Based on the result of physico-chemical characteristics, sensory attributes and microbial test, the Composite Vegetable squash with 50% tomato+50% pumpkin+1% ginger was selected as best formulation and could be stored for 12 weeks without any significant changes in quality characteristics.

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Study on the Impact of combination of different C:N ratio organic manures on nutrient release

D.K.S.M. Daraniyagala

Identification of organic materials, which can enrich the soil organic matter pool and improve the productivity of marginal lands, is a necessity in tropical countries. A study was conducted to comprehend the effect of organic materials of different quality on the soil carbon (C) pool size and N, P, K release from soil. Organic amendments (OA) with different complexities namely, Poultry manure(PM), Paddy Husk(PH), Gliticidia (G) an incubated for two months, were used in a leaching column study, soil incubation experiment and greenhouse experiment using Okra as the test plant. The N, P and K release pattern from soil, soil organic matter content and biomass of Okra in organic amendments added soils compared to soil-only (S) treatments were determined. A leaching column study and incubation study was conducted at soil science laboratory, and plant biomass study was conducted greenhouse study, Eastern university, Sri Lanka during November 2015 to February 2016 to study the combination of different C: N ratio organic amendments on nutrient release. All amendments were applied alone (2 treatments) and combination with Poultry manure,paddy husk and Gliricidia (2 treatments) at the rate of 1% dry basis. The five treatments including soil were replicated four times in a completely randomized design(CRD).The amendments were added to sandy regosol soil which was collected from Eastern university, Vantharamoolai area,,Batticaloa having electrical conductivity 263µs/cm and soil pH 6.8.Treatments were mixed with soil, filled in column and plastic bucket and then incubated in room temperature for two weeks after incubation period, known amount distilled water was added to each column in two weeks interval and four leachate were collected individually. In incubation study plastic bucket were saturated using distilled water and once a week measured for microbial activity. Then these leaching column and incubation buckets were measured for Nitrogen, phosphorous, Potassium, Carbon. In green house study plant biomass was measured. The results revealed the combination of different C: N ratio of organic amendments release more nutrients to the soil. That results revealed the highest nitrogen release have observed Soil+gliricidi (T3) treatments, Highest phosphorous and potassium content have observed Soil+ Poultry manure(T1), and highest carbon content have observed soil+ poultry manure+ paddy husk (T2) treatment. Control soil had lowest nitrogen (N), Phosphorous(P), Potassium(K) and Carbon(C) content compared to organic

manure amended treated soil at the end of incubation and leachate collection. Results could be concluded that the response pattern of decomposition of organic manure and different C: N ratio of organic amendments during the incubation.

Supervised By: Dr. (Mrs). P. Premanandarajah
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Study on preparation and storage of jam incorporating carrots (*Dacuscarota*), banana (*Musa acuminata*) and lime (*Citrus aurantifola*)

Ann Dilukshi Rushani Silva

The production and consumption of preserved foods have gained much importance due to globalization and they provide a health benefit apart from the basic nutritional functions. Therefore, a study was conducted to develop a jam incorporating carrot, banana and lime. Considering the findings of several preliminary studies, five formulations of the jam were prepared by blending different percentages of carrot, banana and lime including control (where only carrot was added). The freshly prepared formulations were subjected to physico-chemical and sensory analysis. Physico-Chemical parameters such as pH, TSS, titrable acidity, ascorbic acid content, total sugar and non-reducing sugar and organoleptic qualities such as colour, aroma, taste, spread ability and overall acceptability and microbial analysis (total plate count) were analyzed after formulations. Physico-Chemical Analysis of the freshly prepared Carrot –Banana-Lime Blend jam showed increasing trend in titrable acidity (from 0.8 to 0.96, as % of citric acid), TSS (from 70.05 to 67.5 ^{0}Brix), ascorbic acid content (from 0.83 to 11.465 mg/100ml), reducing sugar (from 15.64 to 20.553%) with increase in carrot pulp from 50 to 100%. pH, total sugar and non-reducing sugar were also reduced when carrot concentration is increased. Five point hedonic scale was used to evaluate the organoleptic characters. According to Duncan's Multiple Range Test, the mean scores for all the assessed sensory characters varied significantly ($p<0.05$) in the freshly made carrot-banana-lime blend jam formulations. Based on the physico-chemical and sensory analysis, the most preferred carrot:banana combinations of 50:50, 100:0 and 80:20 (T1, T2 and T5) were selected for storage studies .The formulations were stored at 30^{0}C room temperature and 70-75% of RH for 12 weeks. The physico-chemical characteristics were measured at two weeks interval during storage. The decreasing trends in pH and ascorbic acid and an increasing trend in TSS, titrable acidity, total sugar, reducing sugar and non-reducing sugar were noted with advancement of storage periods of 12 weeks. The results of chemical analysis showed that, there were significance differences ($p<0.05$) between the tested formulations. Sensory evaluation was done for carrot –banana-lime blend jam after a period of 12 weeks through a panel of 16 semi-trained panelists. The sensory analysis showed that there were significant differences ($p<0.05$) for organoleptic characters between carrot-banana-lime blend jam

formulations. The highest overall acceptability was observed in formulation with 80% carrot and 20% banana pulp. Microbiological Analysis was carried out on the day of preparation, 1 month, 2 months and 3 months after preparation. No bacterial growth was observed in the freshly made carrot-banana-lime blend jam. There were no counts of yeast and moulds and coliforms in all treatments after the heat treatments and during the storage period. Only the bacterial counts (Total Plate Counts) were observed after three months of storage below the critical level and the all formulations were microbiologically safe for consumption. Based on the results of physio-chemical characteristics, sensory attributes and microbial test, the carrot–banana-lime blend jam with 80% carrot and 20% banana (T2) was selected as best formulation and could be stored up to 12 weeks without any significant changes in the quality characteristics.

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The Effect of different rate sequential application of nitrogen on growth and yield of capsicum

W.R.A.G. Madhusanka

Capsicum (*Capsicum annum L*) is a vegetable of solanaceae family and demands higher amounts of nutrients for good harvest. A field experiment was conducted to investigate effect of different quantity of basal nitrogen (N) and different sequential application of nitrogen on growth and yield of capsicum. Randomized Complete Block Design was used with three replicates. Treatments used were T_1 (0 kg N/ha), T_2 (40 kg N/ha as basal + 4 splits of 30 kg N/ha), T_3 (80 kg N/ha as basal + 4 splits of 20 kg N/ha), T_4 (120 kg N/ha as basal + 4 splits of 10 kg N/ha), T_5 (160 kg N/ha as basal + no top dress), T_6 (45 kg N/ha as basal + 2 splits of 45 kg N/ha). All other cultural practices were maintained and Neem kernel extract was applied as every week for manage the pest incidence. This study showed that a significant difference in capsicum yield among the different treatments. T_3 (80 kg N/ha as basal and 4 splits of 20 kg N/ha of N) treatment given the highest capsicum yield (12.96 mt/ha), Plant nitrogen uptake was 1.08g N/plants this treatment where as the recommended and potassium uptake (4g/plant). Dose of P gave only 0.14g P/plant. Treatment did not significantly affect the pod length, pod girth and root length. The results obtained from this study showed that capsicum yield was dependent on rate and time of N application. This practice of N application can be suggested to farmers for cultivation of capsicum.

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A study of Production and Marketing of Pepper in Matale District

J.Randima Wickramasinghe

Pepper is an important spice crop grown in the Matale District mainly for export purpose and domestic consumption. Varieties of pepper being grown are mainly Sri Lankan local variety and a less extent under 'Panniyoor'. Pepper production had shown variations over the years due to poor management and low productivity. This study was conducted to analyze the production levels, income and profitability of pepper cultivation in Matale District. A sample of 100 farmers were selected for the study. The results indicated that the average extent of land under pepper cultivation was 4.78 acres, with 66% of these lands under local varieties, while the rest had a mixture of local and 'Panniyur' varieties. Labor use consisted of both family and hired workers and the hired labour came mainly from the same villages. They were used for harvesting and for trimming support trees and was paid on a weight basis of raw pepper harvested or on a daily basis. Fertilizer was the only input applied by of farmers. The average cost of production was Rs.39, 700 per acre and the mean yield of pepper was 618 kgs per acre. Few of farmers were involved in processing raw pepper into dried pepper which fetched a higher price compared to for raw pepper. Majority of farmers sold their pepper harvest to wholesalers directly or to traders in town markets. Full time involvement in the pepper cultivation, farmers experience, total cost per acre, Contacts with the extension officers, participating in training programs and membership in a farmer organization had significant impacts on the pepper yield harvested per acre. There is no significant difference on farm gate prices they received by small scale and large scale farmers. There is a significance difference of the total cost of production of pepper per acre between small scale farmers and large scale farmers.

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A study of Tea Smallholders supply of fresh tea leaves to a Tea Factory at Kuruwita DS Division in Ratnapura District

Priyanthi M. Dayananda

This study was broadly designed to analyze tea smallholders supply of fresh tea leaves to a tea factory in Ratnapura district. In the study, quality and quantity of fresh tea leaves supplying processs was analyzed. The study was mainly based on primary data obtained from a sample survey in three G.N. divisions in Kuruwita D.S. division in Ratnapura district. 110 numbers of smallholders in the study area were selected randomly as the respondents and data were collected through pretested questionnaires. Secondary data also used for this study. Data were analyzed using a SPSS. Descriptive statistic, frequencies and multiple regression were done. Aspects of socio economic features of farmers, productivity parameters, cost of tea cultivation, constrains in tea cultivation and reasons for reduction of supplying quality and quantity of fresh tea leaves to the tea factory were studied. All of the smallholders had own tea cultivation land and some smallholders had used hired workers for tea cultivation. All smallholders had used tea cuttings as planting material. It was found that low price for fresh tea leaves, low quality of fertilizer, limited time to maintain tea cultivation and severe diseases were the major problems faced by tea smallholders. The main sources of fresh tea leaves supply to the factory were by smallholders directly and tea leaves collectors in the D.S. division. This study found that most of the tea smallholders had old cultivation land and had another main occupation. Currently tea cultivated lands were not properly maintained and some lands were abandoned, because of lack of time to maintain their tea lands. The cost of production of fresh tea leaves per kg was Rs.17.50. Yield, tea smallholding extent had a significant impact on amount of fresh tea leaves supplied to the tea factory.

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Climate change adaptation strategies by paddy farmers in Anuradhapura District

H.M.L. Herath

Climate change is inevitable and will continue into the next century. Since the agricultural sector in Sri Lanka is one of the most vulnerable to climate change, a thorough understanding of climate transition is critical for formulating effective adaptation strategies. This study provides an overview of the status of climate change and adaptation in the paddy sector in Anuradhapura District. The review clearly indicates that climate change is taking place in Anuradhapura in terms of rainfall variability and an increase in climate extremes and warming. Research efforts are needed to develop and identify adaptation approaches and practices that are feasible for smallholder farmers, particularly in the dry zone where paddy and other food crops are predominately cultivated. The study examined the socio economic profile of the households, perception of changes in the climate variables, motivating factors to adaptation strategies, knowledge on the appropriate adaptation options, future adaptation options and Policy and Strategic Interventions for long term resilience. These five D. S. Divisions were selected based on the data of high vulnerable areas to climate change. Proportionate sampling was done and from Nuwaragampalatha East, Nuwaragampalatha Central, Thalawa, Thambuththegama, and Mihinthale DS divisions and total samples of 100 households were studied. The average age of head of household was 52.9 years. The average household income was Rs 34510.00 per month and the annual average income from paddy farming was Rs. 77800.00 per acre. The total amount of cultivated area was 2.150 acre in Yala and in the Maha was 2.24 acre. It was also important to note that 54 % of all respondents perceived rainfall being abnormally increasing these years than before. As for temperature, 53 % perceived that it has been fluctuating. 87 % of all 100 respondents were found to believe that the negative effects climate change motivating them to change their farming practices in all the 5 DS divisions. The result showed more farmers (55%) heard the term adaptation to climate change. A large number of farmers had adequate knowledge of climate change and its coping strategies. As evident in majority of the farmers provided a correct response to the knowledge check statements on climate change and its adaptation strategies. The identified practices included planting improved rice varieties such as new paddy that offer farmers higher yields instead of the traditional breeds, shifting to shorter cycle crop varieties, which can take short periods of time like three months from

planting to harvesting; shifting to drought tolerant crops and varieties; Use of supplementary reservoir for water storage and by insuring farm against risk. The relative importance of adaptation strategies to climate change was calculated and it showed increased use by insuring farm against risk was ranked first and thus most important. Access to climate and adaptation related information is one of the important aspects, farmers were depended more sources. Television (54%) ranked the first source of information to paddy farmers. The analysis of data identified three main options each of which had a score of well over 50 % as follows: continue changing agricultural practices in line with the changes in the local climate, ask for food aid, and promote irrigation using underground water. T test results revealed that there was a significant difference ($p<0.01$) observed in the total amount paddy production, those who had choosen traditional and cultural knowledge including forecasting and those who didn't choose.

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Economic Analysis of Maize Production in Galnewa DS division, Anuradhapura District

Duminda S.A. Herath

Maize is the most important coarse grain, for which around 30,000 ha of land area devoted annually, the second highest extent of land next to rice. Maize is traditionally cultivated during the 'Maha' season throughout Sri Lanka. A rise of domestic requirement of maize and imports was observed in year 2014. With the expected growth of per capita national income, demand for poultry products and maize are expected to rise in the next decade. The main objective of this study is to analyze the maize production and marketing activities in Galnewa DS division, Anuradhapura District from farmers' perspective, and recommend solutions to overcome constraints faced by farmers. Both primary and secondary data were used in this study. Primary data was collected from 100 maize farmers using structured Questionnaires about maize production. The random sampling method was used for the primary data collection among the maize farmers in the Galnewa DS division. Results indicated that majority of respondents were involved full time in farming. All the respondents grow maize during the 'Maha' season under rainfed conditions. .Mmajority (78%) of farmers use both family members and hired labors. Hired labor was used for harvesting (85%) and for ploughing (53%). The average total cost of cultivation in 'Maha' season was not significantly lower than that of the 'Yala' season per acre. The study results reveal that the average yield in 'Yala' season was significantly higher than the yield in the 'Maha' season. About 62% of farmers sell their product through middleman. None of the farmers had obtained loans for maize cultivation and they have not insured their maize lands. The respondents were neither exposed to extension services nor participated in any training programs. The study revealed that the gross income of maize farmers in 'Yala' season was higher than the income in the 'Maha' season. The maize farmers 'Maha' season profit was significantly lower than that of the 'Yala' season. Marketing efficiency in 'Maha' season 2.61 and in the 'Yala' season 3.06, indicating that 'Yala' season cultivation was more profitable. It was evident from the regression results that profit in 'Maha' season maize production was significantly affected by total yield, extent of land, farm gate price and seed cost. It is recommended that better extension services for maize farmers and provision of more irrigation facilities provided during 'Yala' season to increase maize production and improve farm income.

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Effect of agricultural livelihood project on socio economic status of rural families in Manmunai South West DS division of Batticaloa District

Kiruthiga Balachandran

Sustainable livelihood development projects are a vital modern method in fighting poverty and reducing unemployment. An agricultural livelihood project had been implemented by the World Vision Lanka in the Manmunai South West DS division of Batticaloa district during the period 2010 – 2015. The interventions were channeled through four programmes; "Family Development Plan", "Goat village", "Cattle rearing" and "Poultry development" in the area. A research was carried out with the objective to identify the extent to which the agricultural livelihood development project affect the socio economic status of people in Manmunai South West DS division. The questionnaires were administered to a random sample of 100 project beneficiaries through personal interview in selected five GN divisions *viz* Mavadimunmari, Pandariyaveli, Kuluvinamadu, Kadukamunai and Katchenai. Data were analyzed using SPSS by employing frequencies, percentage, correlation co-efficient and multiple regressions. Based on cumulative livelihood status score of nine livelihood indicators, 34% of the respondents were attained high livelihood effect. Especially the areas of education, health, food security, training facilities and income generation considerably increased over the last five years when compared with baseline data. The personal and socio economic characters of farmers reveal that, more than half of them under middle age category (54%), female number (58%) was higher than male. Around 62% were educated up to primary education and 50% of respondents having medium family size (4 to 5 members). About 73% were doing farming as their part time occupation and main occupation was wage labor (35%). The average farming experience of the respondents was recorded as 11 years. Among the total beneficiaries, 82% succeeded in their project activities. Significant satisfaction reported for goat and cattle rearing. Eleven parameters were used to describe the total effect of livelihood project, only 5% of them had adequate food consumption pattern, only few of them had better health security (24%), 37.7% of child achieved high transformation, 41.7% of the adults achieved high transformation. After the implementation of the project the mean income level was increased from Rs 9, 160 to Rs 14, 790. Among seven socioeconomic variables selected, five variables *viz*., age, education, training participation, extension participation and family size showed positive and significant relationship at 0.01 level of probability,

whereas age and farming experience showed positive and significant relationship at 0.05 level of probability with total livelihood effect. Multiple regression analysis was carried out for determining the contribution of independent variables to the effect of livelihood project and the co- efficient of determination (R^2) of independent variable was 0.638. The livelihood project had made some visible positive changes on the socio-economic situation of rural people in Manmunai South West DS division of Batticaloa district.

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Environmental valuation of the Pigeon Island, Trincomalee District, Sri Lanka: A Travel Cost Method

I.G.N.S. Ilukdeniya

The coastal ecosystem is essential to life on our planet and supports the livelihood of people living and depending on coastal resources. Moreover it is essential for the maintenance of biodiversity and ecosystems, in addition to primary and secondary production functions that support human needs. Valuation studies of coastal resources will considerably increase our knowledge of the value of ecosystems. Their usefulness has often been undermined due to undervaluation which was the main reason for coastal resources destruction. Understanding the recreational value of the natural resources is fundamental to effective conservation programs. The purpose of this research is to explore the recreational value of the Pigeon Island. There has been a multiplicity of recent valuation studies on coastal and ocean resources. However, coastal resource valuation is still a new field to the Sri Lanka where a series of distinct and challenging issues still exist. At present, in Sri Lanka, economic evaluation of coastal resources has just been drafted out and there are no mature theories and models encouraged. So far, there were no studies found on the estimation of recreational value of the Pigeon Island, Sri Lanka. Pigeon Island was designated as a sanctuary in 1963. In 2003 it was redesigned as a national park. It's one of Sri Lanka's best coral reefs existence areas. This research is an application travel cost method (TCM) to measure and analyze the recreational value of the Pigeon Islands. Descriptive statistics was done for questionnaires to explore the socio economic status of the visitors. The result indicated most of the local visitors came to the Pigeon Island were private employees (48%). 68% of the local visitors in the sample had education level up to tertiary level of education. 42% of the foreign visitors were educated up to Bachelor's or equivalent level, 38% up to Master's or equivalent level and 20% up to Doctoral or equivalent level. 98% of the local visitors and 96% of the foreign visitors visited the Pigeon Island as a group visit. 56% of the visitors had the group size of 2-5. According to the results, the use of Pigeon Island for diving purpose was ranked by 74% of local visitors as the most preferred activity and 98% of the foreign visitors ranked the diving purpose as their most preferred activity and 54% of them used Island for boating. Average willingness to pay of the foreign visitors for entrance fee was Rs.1560 and the average willingness to pay of the local visitors for the entrance fee was Rs644.00. Rs.3726.60 was spent on the Pigeon Island visit by local visitors where Rs.5320.00 was spent by the Foreign visitors. T- Test was used to find

out the significant different between foreign visitors and local visitors for their total willingness to pay on the Pigeon Island visit, hours of spending on Pigeon Island visit, willingness to pay for entrance fee, cost for boating per hour, cost for diving visit and cost for whale watching. T test result showed that significant different ($p>0.01$) was observed between foreign visitors and local visitors for total willingness to pay on the Pigeon Island visit, hours of spending on the Pigeon Island, willingness to pay for the entrance fee, cost for boating, cost for diving visit and cost for whale watching. Chi-square analysis was done to find out the association between different variables. Chi square analysis showed that there was a high significant association observed between the total willingness to pay of the local visitors and the education level of the respondent ($X^2=76.75$, $p < 0.01$). There was a significant association observed between the total willingness to pay of the local visitors and the cost for boating in the Pigeon Island ($X^2=36.52$, $p < 0.01$) and the marital status of the respondent ($X^2=71.22$, $p < 0.01$). Multiple regression analysis was done to explore the factors affecting travels of visitors on their total willingness to pay. Multiple regression analysis showed that total willingness to pay of the visitors was significantly affected by age of the respondent, hours of spending, number of the group members and expenses for meals.

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Labour use pattern and cost of production in Soybean cultivation in Anuradhapura District, Sri Lanka

A.V. Dhanapala

There is a space for substituting hired labour by family labour in small scale soybean cultivation. Therefore, this study analyzed the effect of hired labour with the other costs of ploughing, seed, fertilizer, pesticide and harvesting on total income in soybean cultivation by multiple regression analysis. Difference in profit between using and not using the hired labour was obtained by paired t-test. 81 respondents were selected from 5 divisional secretariat divisions of Thalawa, Thambuththegama, Nochchiyagama, Glenbidunuwewa and Mihinthale by simple random sampling in Anuradhapura district of Sri Lanka. Hired labour use was observed in all cultivation practices. Total cost per acre was found to be Rs. 48430.00 ac^{-1}. The mean hired labour cost found to be Rs. 19935.06 ac^{-1} with the minimum and maximum of Rs. 5000 and 28000 ac^{-1} respectively. Multiple regression analysis resulted, Seed and transport were positively ($p \leq 0.05$) affecting the income. Fertilizer and pesticide cost showed negative effect ($p \leq 0.05$). Significant ($p < 0.05$) difference was observed between the mean values of profit with and without hired labour cost. The profit with labour cost was Rs. 169,440.26 and without labour cost was Rs. 189,375.32 ac^{-1}. Soybean cultivation is a profitable enterprise. In the studied sample, hired labour cost has no significant ($p \leq 0.05$) influence in income while it makes significant difference in profit of soybean cultivation. If farmers use the family labour in place of hired labour that expenditure could be utilized to purchase processing machineries of soybean based products.

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Organic food consumption among urban consumers in Batticaloa District

Kirijini Selvarajah

The trend towards consuming organic food is growing among people. There is a necessity to study what actually induces consumers to turn towards organic food. In this regards a study was conducted to identify the organic food consumption pattern among the consumers in three urban areas in Batticaloa district namely Manmunai North, Kattankudy and Eravur Town. The study also focused on the influential effect of attitude, perception and consumer motivation related to organic food consumption and investigates the factors that limit the consumption of organic foods. After reviewing relevant literatures a research model was developed. The research was based on primary and secondary data sources. An exploratory study was conducted involving randomly chosen 100 urban consumers in Batticaloa district. Individual interviews involving questionnaire survey were conducted in each urban council among the consumers at food purchasing places. The study employed descriptive statistics, coefficient of correlation and the regression to analyse the resulting data. The study predicts that organic food consumption has significant relationship with total knowledge, consumer perception, consumer motivation, product related factors, health consciousness, environmental consciousness, number of household members and monthly income. The survey revealed that 73% of the respondents have high knowledge regarding organic food. The prominent motivating factors to purchase organic foods include environmental concern, health concern, safety, product quality and trust. Conversely, trust, price, accessibility, assortment, shelf life, taste, and lack of time to look for organic food are the main factors that limit the consumption of organic foods.

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Ornamental Pond Fish Cultivation (rear fry and fingerlings) inside the Paddy Farms in Polonnaruwa District, Sri Lanka

M.P.S.D Sri Lankartha

Rearing of fish inside the ponds in paddy fields is an aquaculture activity carried out by paddy farmers as an additional income earning livelihood in Polonnaruwa district Sri Lanka. Therefore, this study explored the opportunities and challenges of this activity. Primary data of 80 producers in 3 major pond cultivating Divisional Secretariat divisions via proportionate stratified random sampling was used in this study. Descriptive statistics and regression analysis to determine the factors affecting income of this activity were used. The mean extent of land cultivated for paddy farming and ponding were 2.26 and 0.2 acres. The mean total income obtained of these two activities were Rs. 290,000 and 433,000 respectively. The average pond size was 5600 ft^2 and the depth of 3 ft. The major ornamental species cultivated were "Carp" and "Gold fish". 3 batches were cultivated throughout the year with the mean stocking density and yield of 7600 and 6000 couple of fish. Family labours were mostly involved. They fed naturally available feeds from their village. Total mean fixed and variable cost were Rs. 458,600 and Rs. 191,000 per acre while the total income obtained from first batch was Rs. 763,800. All farmers considered topography and water availability during pond construction. National Aquaculture Development, National Aquaculture Research and Mahaweli Authorities facilitated this activity. 70% of the farmer prefer this activity for higher income within short time and low labour usage. High risk and require higher knowledge were the disadvantages felt by them. Impact from predators and lack of required knowledge were the constraints faced by them. They suggested provide careful attention, pond covering and good training, instructions to enhance this activity. The regression model resulted experience and extent of land of ponding, stocking density, average mortality rate was significant ($p<0.05$) in explaining the dependent variable of total income among the other factors of number and size of pond, variable cost of production.

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Production and marketing of Bibile Sweet Orange (*Citrus sinensis* L. Osbeck) in Moneragala Distric, Sri Lanka

K.S.D.A.Kumarasiri

The study identified the production and marketing aspects of sweet orange cultivation in Monergala District, Sri Lanka. The objective was to find the extent and ownership of land, type of labour uses in management practices, different costs, average yield and income, prices paid, marketing outlets. 90 growers by proportionate stratified random sampling among Bibile, Medagama, Moneragala and Medulla Divisional Secretariat divisions were used. Descriptive statistics and frequency analysis were used to find the results. Average extent of land, experience in orange farming, number of fruiting trees and mean number of fruits acre^{-1} were as 1.36 acres, 10 years, 59 and 25,595. Mean education level was 8.5 schooling years. Total cost of production, income and profit acre^{-1} as Rs. 15,282.53, Rs.283090.74 and 267808.20. The seedling, transportation, land preparation and harvesting cost were Rs. 10101.19, 1819.53, 1302.03 and 3163.88. All farmers were practiced major management practices in cultivation. 30% not practiced pruning practices. Family labors were used for management practices. 37.7% and 40% of labors were hired for land preparation and planting of seedling. Sustainable practices also adopted. Die back disease and fruit fly attack was experienced by 94.3 and 69.3 percent. The problems were responded as pest and disease by all, insufficient water (67.1%), lack of extension services (61.1%), low price (71.2%), low demand (78.1) and unreliable market (73.7%). The major marketing channel flowed through producer, middlemen, urban market (wholesaler), retailer and consumer. The prices paid at middlemen, urban market and retailer were as Rs. 14.27, 21.07 and 10.95 fruit^{-1}.

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Status of water pollution; sources, effects and strategies for prevention in Gampaha District

S.A.U.M. Senanayake

Water pollution has become a critical issue with rising population by urbanization and development activities especially in the urban areas of Sri Lanka which has a negative impact on environment. The study examined the socio economic profile of some selected households in Gampaha District in terms of water pollution, impacts, knowledge on water treatment methods, household water use patter, the factors affecting the alternative water sources used by household and any strategies to prevent the pollution. Proportionate sampling was done from Divisional Secretariats of Gampaha, Kelaniya, Biyagama, Negambo and Ja-Ela. Total of 100 households and 20 industries were selected for this study. Multiple linear regression analysis and Chi-square analysis were used to determine the factors that influence the cost of alternative water sources used by households. The study revealed that the average age of head of households was 48.4 years and the mean family size of a household was 4 persons. The average household income was Rs. 38970.00 per month. All households had knowledge on water pollution and related impacts from school and media. About 47% of households were faced problems on contamination of water in Gampaha District and majority of them were suggested that the pollution may be due to industrial and agricultural activities. Inevitably, almost all households were affected by water related diseases and 93% households were mainly affected by Amoebiasis due to the water pollution. On average, each household spent Rs.1172.70 per year for treating water related diseases. Majority (96%) of households were using water supply for their daily use due to the lack of space to construct well within the premises. About 88% of households were disposed their wastes in open places**.** Multiple linear regression analysis was used to determine the factors that influence the cost of alternative water sources used by household. The results showed that type of water used for drinking purpose were significantly influenced the cost for alternative water sources ($p<0.01$). And also major problems with getting good quality water were significantly influenced the cost for alternative water source ($p<0.05$). An increase in total income per month by one rupee will decrease the cost for alternative water sources per month by 3 Cents ($p<0.05$). About 90% of industries caused water pollution directly or indirectly in the study area. Most of the industries caused water pollution by open discharge of waste water and dumping untreated solid waste in the region. About 50% of industries were

treating their waste by chemical precipitation and landfill. It is recommended that the public and private health sectors must take initiatives to educate the people and the government must take immediate measure to carry out water testing to analyse the quality of their well, advise them on the impacts and health related problems. It is recommended that there should be an initiative to have a small scale purification device or plant to reduce the risks of pollution and it is highly recommended that there should be a rain water harvesting system in every household to utilize the rainwater for their daily use. And also the government must supply clean water to entire affected are through present water supply scheme in order to avoid people in drinking polluted water. It is highly recommended that the Local authority must instruct industries and households which produce solid wastes which is one of the major sources of water pollution in the study area by making compost using their wastes.

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Study on milk collection and supply units in Sammanthurai DS division of Ampara District

Selvaraja Arulanantham Sinthuja

A study on milk collection and supply units in Sammanthurai DS division of Ampara District was carried out during the months from November 2015 to January, 2016. Using the random sampling procedure 80 milk producers were selected for this study. Relevant information also gathered from two milk collection centres; Milco Private Limited and Pelwatte Dairy Industries Limited. A structured interview schedule was used to collect the information through personal interviews. Data were gathered at the milk collection centers and farmers' home. Gathered data were analysed using the SPSS version 17.0. Results of the study indicated that majority of respondents were under middle age (36 to 55 years) category. Around 81% of the farmers were male and majority of the dairy farmers were Muslim. About 47% of farmers had received primary education. Further, half of the population belonged to medium income group. Around 38% of farmers had 5-15 years of farming experience. Majority of the dairy farmers (75%) supplying only cow milk to the milk collection centres and rest of them supplying both cow and buffalo milk. There were no any differences observed between the buying price and selling price of milk. According to the statement of the respondents major constraints experienced were price fluctuation and adverse climatic conditions. Further, few of them stated lack of transport facilities as one of the constraints, specifically by the farmers who supplied milk for Pelwetta milk collection centre. Chi-square analysis was done to find out the association between the amount of milk supplied per day and selected socio-economic characteristics of dairy farmers. A significant association was observed between the quantity of milk supplied per day and age of the dairy farmers, herd size owned by the dairy farmers, distance from the center and communication source used by the dairy farmers.

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Adoption of micro irrigation system for vegetable cultivation in Polonnaruwa district, Sri Lanka

M. D. Udagedara

Micro-irrigation System (MIS) is proved to be an efficient method in saving water and increasing water use efficiency as compared to the conventional surface method of irrigation. However, use of MIS in Sri Lanka especially in the dryzone is very low. In this view, the study was designed to find the adoption of micro irrigation system for vegetable cultivation in five DS division of Polonnaruwa district. Primary data were collected from 150 farmers using structured questionnaires, direct observation, field visit and personal interview. Results showed that, 17.3% of farmers adopted MIS in the study area. Most of MIS adopted farmers' family income was higher than the MIS not adopted farmers due to the reduction in labour cost and the selection of higher value crops for the cultivation. Most of MIS adopted farmers (65.4%) were cultivating vegetable in both seasons and 88.5 % of them pointed that their yield was increased by adopting MIS. Higher initial cost (Rs.150000 per/acre) was the major drawback in implementing MIS system in the study area. Lack of capitals and knowledge were the major constrains for adopting MIS. Therefore, regular extension services, training program and supply of subsidies for establishment MIS are very essential in the study area to enhance the water use efficiency by adopting MIS.

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Assessment of sub-leachate pollution index (SUB -LPI_{hm}) to determine the heavy metal pollution potential of landfill leachate at Karadiyana landfill site

M. A. R. D. P. Wijesinghe

Leachates from landfill site cause environmental degradation and health hazards due to resultant ground water pollution. A technique to quantify the leachate pollution potential of solid waste landfills on a comparative scale is the use of index known as the leachate pollution index (LPI). The sub-LPI_{hm} is a quantitative tool by which the leachate pollution potential of heavy metal of the landfill can be reported uniformly. The sub-leachate pollution index for heavy metal provides a convenient means of summarizing complex about heavy metal pollution data and facilitates its communication to decision makers and the general public. This study attempted to assess a sub-LPI_{hm} of Karadiyana landfill site which is located between Thumbowila and Werahera in Kesbewa Divisional Secretariat Division in Colombo district. Delphi technique was used to select the initial set of parameters. This involved an opinion survey of 30 experts working in the disciplines of environmental chemistry, environmental toxicology, pollution control, water quality, etc. The sub-LPI_{hm} formulation process involved in selecting key variables based on expert ratings and deriving the rating curves for selected 5 heavy metals. The sub-LPI_{hm} was calculated by using the software (Matlab 7.0), Version 7.0.0.19920 (R14). To make the sub-LPI_{hm} more informative, leachate samples were collected monthly during the period of September, 2015 to January, 2016. Samples were analyzed for Lead, Zinc, Nickel, Chromium and Arsenic which were selected based on the expert opinion survey. The sub-LPI_{hm} values of the points were A (0.5267), B (0.5159), C (0.2603), D (0.0824), E (0.0814), F (0.0866) and G (0.1493). The overall sub-LPI_{hm} valve of Karadiyana landfill site was 0.2433.
In this study, it was also found that the sub-LPI_{hm} values were changed by the influence of the parameters such as rainfall, temperature, pH and distance from landfill site. There was a positive correlation between sub-LPI_{hm} and pH, sub-LPI_{hm} and temperature while negative correlation between sub-LPI_{hm} and distance from landfill site, sub-LPI_{hm} and rainfall.

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Efficiency of coagulation processes for the treatment of groundwater

Jeevasuluxey Jeevaratnam

Groundwater is created by infiltration of precipitation, surface runoff or water stored in surface bodies including rivers and lakes to an aquifer. Ground water quality is important as it is the main factor determining its suitability for drinking, domestic, agricultural and industrial purposes. In some area turbidity of ground water is high. Turbidity is an easily measured parameter in water treatment that provides information about water quality. In drinking water treatment, alum coagulation and flocculation are common processes used to remove turbidity and NOM. In these processes, the addition of alum typically neutralizes negatively charged particles in solution minimizing electrostatic repulsive forces. This leads to the formation of particles which aggregate into larger particles known as flocculant particles or "flocs". The aggregated flocs can then be removed by filtration. This study was designed to explore the optimal alum dose required to treat the ground water in Sithandi village, Sithandi GN Division in Eravur Pattu DS division, Batticaloa District. The totals of 15 wells were selected randomly from the village for analyzing samples and questionnaire survey. The most problematic well was selected from analyzing samples and questionnaire survey to collect the samples in the period from November 2015 to January 2016 with three replicates to analyze the water quality parameters at laboratory of Agricultural Engineering, Faculty of Agriculture, Eastern University, Sri Lanka. Water quality parameters tested include Turbidity, Alkalinity, Total Suspended Solids, Total Dissolved Solids, Total Solids, Electrical Conductivity, pH and Temperature. Collected water sample was treated with Ammonium alum at different dosage (control, 2.5 mg/l, 5 mg/l, 7.5 mg/l, 10 mg/l, and 12.5 mg/l) with three replicates. After the addition of alum, water samples were mixed for 1 min in 200 rpm then for 20 min in 40 rpm by using shaker and allowed 20 min to settle (Jar test). After the coagulation process, water samples were filtered through 0.45 µm filters. It was found that Turbidity reduction is most effective at 5 mg/l alum dose.

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Estimation of Mechanization Index and Analysis of Agricultural Productivity in Bandarawela

K.A.D.P. Karunarachchi

This study was designed to determine the mechanization index of different up county vegetable crops and to evaluate the power per unit area of vegetable cultivation in Bandarawela DS division and to determine the productivity of machinery and labour and the Mechanization Index (MI) of vegetable crops in Bandarawela. The present study was conducted using a sample of 100 farmers in five major vegetable cultivation GN divisions of Bandarawela DS division. Stratified random sampling technique was used to draw the sample. A pre-tested structured questionnaire, personal interviews and discussion with key informants were the methods used to collect the primary data. Secondary data were obtained from relevant articles, government centers and key organizations. Tool of data analysis included descriptive statistics, frequencies and regression analysis using SPSS 19.0. Aspects of socioeconomic characteristics of vegetable cultivators, production and cultivation details, mechanization of vegetable cultivation, labour hours and machinery hours, labour and machinery use were studied. The highest index of mechanization was determined as 2.29% for cabbage cultivation and low MI of 0.5% was obtained for tomato cultivation followed by which 1.44% for bean, 2.1% for carrot and 1.97% for potato cultivation which represents a relatively undesirable state of mechanization for the vegetable cultivation in this region. Lowest degree of mechanization of 120.85 kWh/ha was obtained in potato cultivation whereas highest degree of mechanization of 146.86 kWh/ha was obtained in beans cultivation fallowed by which 135.82kWh/ha for carrot, 135.97 kWh/ha for tomato, 139.37 kWh/ha for cabbage cultivation. The highest power per unit area was 1.12 hp/ha in cabbage cultivation and that was 0.72 hp/ha for potato cultivation because land area used for potato cultivation was higher than compared to other crops. This was followed by 0.97 hp/ha for beans, 1.02 hp/ha carrot and 1.09 hp/ha tomato cultivation. Highest productivity of machine was 0.03 ha/kWh in potato cultivation and highest productivity of labour was 0.0006 ha/kWh in cabbage and potato cultivation.

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Farmer's awareness and adaptation on climate change in irrigable areas of Trincomalee district

L.B.F. Musatha

Agriculture is the most livelihood option in Sri Lanka where the farmers experienced many impacts due to the climate changes. However, increasing climatic change has become more threatening to the sustainable economic development especially on agricultural activities and the totality of human existence in most of the dry zone of Sri Lanka. In this view, present study was designed to examine the impacts of climate change and to study the awareness on climate change among the farmers in the irrigable areas of Trincomalee District. Purposive and stratified random sampling techniques have been employed as the major methods of sampling during data collection where a total of 150 farmers were selected from 12 GN divisions. Pre-tested, structured questionnaires were used to collect primary data from farmers while the secondary data were collected from the irrigation department, department of agriculture, meteorological department, Agrarian services department and district secretariat of Trincomalee. Collected data were analysed using SPSS software (version 19). Results revealed that the majority of the respondents those who are involved in farming activities were males (88%) and their education level (53.3%) is an average. Further, majority of the respondents (70%) were engaged in paddy cultivation (60%). Most of the respondents aware about flood (82%) and drought (74%) as the impact of climate change. Reduced crop yield (92%), reduced productivity (83%) and drinking water depletion (53%) are some of the changes observed by the farmers in the study area. Climate change impact highly cause poverty (81%) and reduced the productivity. Among the total cultivated land 60.9% of the extent was affected by the severe flood. These situations are common in all the dry zone of the Eastern Region of the country. Therefore, vulnerability assessments need to be done for future climate hazards as well as current variability in the study area and adaptation measures that address current and future levels of climate change should be given priority.

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Farmer's satisfaction and problems associated with tank irrigation among paddy farmers in Anuradhapura district

S.P. Jayawardhana

Paddy farming is a direct source of income for the majority of the rural farmers in Sri Lanka. Irrigation plays a vital role in improving the productivity of the agricultural sector. Therefore, farmer's satisfaction in utilizing the particular irrigation scheme could be considered for the assessment of the performance of that irrigation scheme. In this view, an investigation was instituted to determine the satisfaction level of the farmers related to the Mahavilachchiya tank irrigation systems. To achieve this target, primary and secondary data were used in this study. Pre-tested, structured questionnaires were used to collect primary data through personal interviews during the period of October, 2015 to February, 2016. Stratified simple random sampling method was used and 150 farmers were selected from seven farmer's organization in the Anuradhapura District. The results of the study indicate that, 57% of the respondents involved in paddy cultivation as a full time occupation. Most of the farmers were involved in paddy cultivation in both Maha and Yala season. Average land extent owned by the farmer was 2.4 ac. Study further revealed that, tank water used for various purposes like irrigation, bathing, washing, drinking, cooking, livestock rearing and cleaning. Poor canal distribution (57.3%), problems due to unseasonal cultivation (2%), damaged distribution channels in many places (99.3%), poor attention in channel repairs (95%), misbehavior of farmers in water distribution (97%) and lack of maintenance on tank bunds and canal system (73.3%) were some of the problems reported by the farmers in the study area. As far as the knowledge on efficient water use is concerned, nearly 43% of the farmers were aware about the water use efficiency. Further, study revealed that 62% of the farmers were satisfied with the use of tank water for irrigation at 51%-75%satisfaction level. It was also observed that head, middle and tail end farmers were satisfied on the use of canal water for domestic purpose at the satisfaction levels of 100%, 100% and 73% respectively. The knowledge on the water use efficiency, repairing of damaged canals, distribution channels and regular cleaning of channels could save some water and thus, increase the extent of cultivation in the study area.

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Influence of Cutting Height and Forward Speed on Header Losses in Rice Harvesting

D.I.E Senevirathne

This study investigated the header grain losses and quality of the grains with respect to different cutter bar heights and forward speeds. The experiment was conducted at Farm Mechanization Research Centre (FMRC), Anuradhapura in a split plot design with three replicates to investigate the effect of cutting height and forward speed of combine harvester (Model CLAAS C210) on header losses of paddy grains. Header losses were assessed at cutting heights of 10 cm, 15 cm, 20 cm and 25 cm and at three levels of forward speeds such as 2.4, 3.84 and 4.28 km/h. The results revealed that the cutting heights of 10 cm, 20 cm and 25 cm resulted in greater header losses. The cutting height of 25 cm gave significantly greater header loss of 37.04 kg/ha accompanied by the significantly lowest header losses of 23.66 kg/ha at the cutting heights of 15 cm. The forward speed of 4.28 km/h had significantly highest loss of 42.41 kg/ha, whereas significantly lowest loss of 23.96 kg/ha was associated with the forward speed of 2.4 km/h and at 3.84 km/h which were not significantly different from each other. The forward speed of 4.28 km/h resulted in significantly greater MOG of 0.0041 kg/ha accompanied by significantly lower MOG of 0.0032 kg/ha at the forward speeds of 2.4 km/h which was not significantly different from the MOG obtained at the forward speed of 3.84 km/h. The cutting height did not have any significant impact on grain damage. However, the forward speed of the harvester had significant effect on decreasing the grain damage. A strong negative relationship between forward speed and the grain damage was observed (R^2= 0.99) at 20 cm and 25 cm cutting heights. The performance evaluation revealed that the effective field capacity increased with an increase in operating speed and it was found to be greater at 15 cm cutting height due to less time taken to harvest the plots.

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Present status and the farmer's satisfaction on the use of Mahaweli Irrigation water at Mahaweli C zone, Sri Lanka

J. Upali

Agricultural activities are carried out in most of the dry zone Sri Lanka with the help of irrigation rather than depending on rainfall pattern. The critical concern of using channel is based on the understanding and analysing the irrigation related problems in broader context of both technical and social aspects. Therefore, this present study was carried out in order to identify the problems and satisfaction level of the Mahaweli C Zone paddy farmers in using Mahaweli water for drinking, irrigation and other utilization. The Questionnaire survey was conducted among randomly selected 150 farmers from the Mahaweli C Zone and analysed in SPSS software (version 19). Farmers' satisfaction level in various needs was identified in both *Yala* and *Maha* Season. The limited land for grazing was the major constraint for the livestock rearing farmers. And also, the major constraints of the paddy farmers were the water allocation (90%). Mahaweli C Zone mainly based on the *Maha* Season for paddy cultivation (100%) where the source of income was typically higher. The satisfaction level of the farmers regarding the drinking water scheme of the Mahaweli C Zone shows that 21% of the total was not satisfied with the drinking water. Awareness program related to community participation in the Mahaweli C Zone regarding the solution in water allocation *Yala* and *Maha* Season and the problems of kidney disease and the weed problem, etc will support for further improvement of the command area.

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Study on collection, composition and management of Municipal solid waste in the areas of Mirigama Urban Council

Harinda Senavirathna

This study consists of a public survey, discussions with local authority staff involved in waste management, discussions with Provincial Council and Government officials, dialogue with people, review of documents and field observations. Study area was Mirigama Urban area in the Gampaha District. Questionnaire was designed to collect primary data from December 2015 to January 2016. In this survey, 60 % of household, 30 % of shops and 10 % of common sites were selected. The collection, composition and management of solid waste in Mirigama urban area were studies. The results stated that average amount of food waste; yard waste, paper/cardboard waste and metal waste at household were 1.53kg, 0.09kg, 0.07kg, 0.17kg, 0.06kg, and 0.16kg per day respectively. Household glass waste generation per/day shows significant negative correlation with the family size. Glass waste shows significant positive correlation with the income level. The majority of household disposal method was 'collection' (77%) by Urban Council and minority (4%) dumps in road side or empty plot. The major issue on solid waste management is environment and health problems. Main challenge of Urban Council is to provide better solid waste management services. Solid waste management services including waste collection, transfer, recycling, resource recovery and disposal were separately discussed. Solid waste collecting tractors and use of high technology waste collection vehicles should be used for collecting the waste and to produce bio-gas in Mirigama.

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A study on dairy cattle production systems in Kotmale

H.K.G.T.N. Bandara

Dairy farming has been an integral part of the rural economy of Sri Lanka. At present, the milk production in the country only meets about 26 percent of national milk requirement. Even the largest cattle population is reported from the dry and intermediate zones the wet and wet intermediate zones produce 50 percent more milk than the dry and intermediate zones. Therefore a detailed investigation of the present status of milk production in wet and wet intermediate zones of Sri Lanka is timely and relevant. This study was conducted in Kotmale in Nuwaraeliya district of the central province from November 2015 to February 2016. The survey covered 95 dairy farmers from 16 villages, which were located in two veterinary ranges of Kotmale and the data were analyzed using descriptive statistics. The study revealed that, a majority (95%) of the dairy farmers in the study area was over middle age group and only 11% of dairy farmers rely on livestock farming alone or rearing it as their primary occupation. There were 92% dairy farmers practicing intensive system and 8% farmers were practicing semi intensive system, 98% of farmers were rearing dairy animal for milk purpose and 2% of farmers rearing cattle for dual purpose. The study proved that almost all the animal present in the surveyed area were pure European breed and cross breed. None of farmers had pure local breeds or Indian breeds. In the study area, majority of dairy farmers feed dairy animal with both grass and concentrate feed. There were 96% of farmers were practicing artificial insemination only and all farmers used dairy house for keeping cattle 93% of farmer used proper shed in the study area. From the study, the average milk production from the European cattle and cross breed cattle were 8.09 liters / animal / day and marketing of milk is very informal and middle man play a major role in purchasing and marketing of milk at the farm gate price of Rs 60 /- per liter and some of the farmers from semi intensive and intensive system sell their milk locally to neighbors at the average price of Rs 60/- per one bottle (0.75 Liter). And low amount of milk is flow through the hotel and rest of the farmers sell to large scale processor (MILCO (pvt) Ltd). In the study area, dairy farmers facing major constraints and problems were resource availability, economic, technical, marketing, and institution and others. The potential for dairy farming in this area can contribute in greater proportion to the economy of the country through the development of the dairy production and removing constraints and problems of dairy farming.

Supervised By: Dr. M.M. Mahusoon
Senior Lecturer Gr.I, Dept. of Animal Science

Availability of waste feed materials for livestock at the markets around the Eastern University premises

H.J.G. Sanjaya

A study was conducted at eight market sellers of four major markets from two Divisional Secretariats divisions in Batticaloa District to identify the availability of feed waste using a pretested structured questionnaire. Collected data was analyzed using SPSS software. Descriptive statistics and frequency analysis were done. Aspects of socioeconomic characteristics of farmers, monthly income, quality of feed waste, customer demand for feed waste and problems were studied. The study revealed that 75% of the market sellers were male and majority of market sellers were involved as own business (96%) and only less numbers involved in farming. The age of the respondents was 41.5 years old and 81% of the market sellers were married. The average monthly income was Rs.25500/= and 37% of sellers were 10-20 years in experience. Mostly available feed wastes were vegetables (41.3%) followed by fish, fruits and meat were 22.5%, 17% and 16.3% respectively. Mostly available vegetable wastes were brinjal, tomato and onion. Pineapple waste was more common in fruit waste. Among the animal feed waste fish was mostly available. Further results revealed that 85% of feed waste was with low quality level and 90% of the respondent was not demanded market level for feed waste. Lack of education of the sellers, low quality of available feed waste, lack of waste treatment facilities, lack of demand for waste feed, poor hygiene and marketing exploitation were most important constraints.

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Development and evaluation of probiotic yoghurt produced by *Bifidobacterium spp.*

E. Powsika

Yoghurt is one of the most important fermented milk products, which has gained great popularity throughout the world for its recognized sensorial, nutritional and health benefits. The study was conducted to investigate nutritional, physical, microbial and sensorial properties of probiotic added yoghurt. Probiotic added yoghurt was prepared using skim milk and its nutritional, sensorial and microbial properties were analysed at day one and during the storage period of 4 weeks. This research was performed in Animal Science laboratory of Eastern University, Sri Lanka. The study was carried out using Completely Randomized Design with 5 treatments and 3 replicates. Probiotic added in yoghurt in the rate of 0%,0.1%, 0.2%, 0.3% and 0.4% in weight basis. At day one quality attributes such as dry matter, ash, fat, reducing sugar, total sugar, pH and titrable acidity were not ($p > 0.05$) changed in different types of yoghurt samples. Syneresis was high in 0.4% probiotic added yoghurt (40.73±2.05) and was lower in without probiotic yoghurt (37.70±1.32). Syneresis increased with increasing percentage of probiotic. During the storage period, dry matter, total sugar, reducing sugar, pH, and titrable acidity ($p < 0.05$) were changed. In case of ash and fat, slightly changes were observed. At the end of storage 0.4% probiotic added yoghurt showed higher value of dry matter, ash, titrable acidity and (21.87±1.40), (1.00±0.40) and (0.67±0.04), respectively. On the other hand, yoghurt made without probiotic showed higher value for reducing sugar, total sugar and pH (2.17±0.02), (10.72±0.21) and (4.38±0.01), respectively. At the end of storage without probiotic yoghurt showed low value of dry matter, ash as (15.80±1.93) and (0.67±0.46), respectively and 0.1% probiotic added yoghurt showed low value (0.62±0.02) of titrable acidity. On the other hand, yoghurt made without probiotic showed higher value for reducing sugar, total sugar and pH (2.17±0.02), (10.72±0.21) and (4.38±0.01), respectively while 0.4% probiotic added yoghurt showed low value of reducing sugar, total sugar and pH as (2.05±0.01), (10.32±0.23) and (4.15±0.04), respectively. During the storage period dry matter, ash and titrable acidity increased with increasing concentration of probiotic added in yoghurt. Whereas reducing sugar, total sugar and pH decreased with increasing concentration of probiotic. Colony forming unit was decreased with the storage period. At the end of the storage all treatments of yoghurt showed reduced value of colony forming unit than 2nd week. Without probiotic showed low value ($4.13*10^5$) of colony forming unit than other

treatments. The results of the sensory evaluation showed that organoleptic parameters had influence on overall acceptability of yogurt product. According the panelist preference of texture colour flavor, they have preferred without probiotic yoghurt. According to the taste and overall acceptability 0.3% probiotic added yoghurt was preferred by panelist.

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Effects of amending different litters (chopped straw and paddy husk) with boric acid on the performance of broiler chickens and the litter quality

P. Madhurika Hashani

Ammonia gas, which is produced as the manure decomposes, has adverse effects on human health, bird welfare and the environment. Using litter amendments can reduce the ammonia emitted from broiler houses. The objective of this study was to evaluate the effects of boric acid to two litter materials (chopped straw and, paddy husk) on broiler chickens performance and various aspects of litter quality. Total of 120, unisex, day-old, broiler chicks were randomly allocated into four treatment groups with three replicates, based on litter types and each replicates consisted of ten birds. The four litter types were chopped straw, paddy husk, boric acid treated chopped straw and boric acid treated paddy husk. The birds were fed a commercial starter diet from 0 to 21 days and broiler finisher diet from 21 to 42 days. Feed and water were provided *ad libitum* throughout the 42 day experimental period. Chicks were placed in floor pens at a final stocking density of 0.07 m^2 per bird. Amount of 40g boric acid was applied to the litter surface of each pens in weekly basis. Body weight gain and feed consumption were recorded weekly and the feed conversion efficiency was calculated. On day 42, the live weight and dress weight of birds were taken and the dressing percentage was calculated. At the end of experiment, the weights of organs such as heart, gizzard, spleen, liver, lungs and bursa of fabricius were measured and the relative organ weights were calculated as a percentage of organ weight to the live weight of birds. Finally, the litter parameters such as temperature, pH, moisture content and ammonia content were measured weekly basis. The results revealed that the broiler chickens raised on the litters such as chopped straw and paddy husk amended with boric acid exhibited significantly improved performance in the broiler chickens. Boric acid amended chopped straw and paddy husk increased body weight gains (by 14% and 11%, respectively), feed consumption (by 6% and 7%, respectively), live body weight (by 14% and 10%, respectively), dress weight (by 21% and 14%, respectively), dressing percentage (by 8.5% and 3.7 %, respectively) and reduced the FCR (by 9% and 4%, respectively) than the untreated groups. A significantly highest relative weight of gizzard (2.2%) was recorded in the birds raised on

untreated paddy husk. In addition, the largest relative weights of spleen (0.13%) and lungs (0.49%) were obtained from the birds raised on untreated chopped straw. The results of litter quality revealed that the boric acid treatment to the litter materials (chopped straw and paddy husk) reduces the litter pH significantly when compared to the untreated litters. In addition, boric acid treatment to the chopped straw reduces the litter temperature when compared to other litter types. However, the moisture content was significantly higher in boric acid treated chopped straw than others. Furthermore, Ammonium ion content was higher in boric acid treated litter materials than untreated litter materials. The higher net returns from broiler production were obtained from the birds which are raised on boric acid treated chopped straw and paddy husk (42% and 40%, respectively) when compared to the birds raised on untreated litters. Therefore, it could be concluded that the performance of broiler chickens increases with the litter amendment by boric acid.

Supervised By: Mrs. L.S. David
Senior Lecturer Gr.II, Dept. of Animal Science

Effect of commercial available probiotic product on the performance of village chickens

U.LD.N.S. Gunasinghe

An experiment was carried out to study the effect of commercial probiotic product on the performance of village chickens. A total of 90, 24-week-old Village chickens were randomly divided into three treatment groups in a Completely Randomized Design. All treatment groups were consisted of three replicates of 10 birds each. Commercial layer diet was used for all treatments. The treatments such as a control treatment consisted of water without probiotic supplement, drinking water mixed with 6g of commercial probiotic/5L water (1200ppm) and 3g probiotic/5L water (600ppm) as treatments one and two, respectively. The results showed that 1200ppm of probiotic had significant effect on hen- day egg production, number of eggs, egg mass, egg weight, feed intake, feed conversion ratio, net feed efficiency index, fertility and egg: feed price ratio ($p<0.05$). In addition, 600 ppm concentration of commercial probiotic significantly improved the same parameters, except egg weight when compared to that of control birds. Therefore, it could be concluded that addition of commercial probiotic through drinking water significantly improves the productive performance in village chicken hens. Furthermore, the productive performance of village chicken hens significantly increases when the birds administrated with 1200 ppm concentration of commercial probiotic than the 600 ppm.

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Effects of dietary replacement of fishmeal by brewery spent grains on growth performance of goldfish (*Carassius auratus)*

W.M.P. Chathuranga

Feeds are crucial elements in aquaculture and can represent up to 70% of total operation costs. Generally the most expensive ingredient in fish feed is fishmeal (FM) being the primary protein source used in fish feeds. As a result of declining supplies and rising costs of FM, Brewer's spent grain (BSG) are being tested as replacements for FM. They are readily available by-products of brewery production been tested with some success in many fish species. In this context, an experiment was conducted using the diet with four levels of BSG (T_1=0%, T_2=10%, T_3=20% and T_4=30%) to determine acceptability, performance, and nutrient utilization by *Carassius auratus* (goldfish). A total of one hundred and twenty goldfish were fed with four experimental diets (treatments). Ten fish were used per replicate, and three replicates per treatment were allocated in a Completely Randomized Design (CRD). Goldfish were fed with the experimental diet from 21 days to 62 days of growth. Feed was fed in *ad libitum* and proper water quality was maintained. The results showed that there was no significant difference in final body weight among the treatments. The average body weight was 4.26±0.05 g. There was no significant difference in weight gain, specific growth rate and length gain among the treatments. The T_3 (20% BSG) recorded highest total length (6.27±0.13 cm) and T_1 (0% BSG) recorded least (5.52±0.06 cm). There were no significant differences in feed converstion ratio of fish among the treatments. T_1 (0% BSG) recorded the highest condition factor (2.49±0.07) and the least (1.78±0.10) was on T_3 (20% BSG). There were no significant differences of incidant cost of fish among the treatments. Hence, BSG could be used to replace highly competitive sources of protein in fish compounded diet up to 30% inclusion level.

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Effects of dietary replacement of fishmeal by cassava leaf meal on growth performance of platy (*Xiphophorus maculatus*)

M.W.H. Harindrika Jothirathna

Because of declining global availability and increasing demand, fishmeal is a major contributor to the rising cost of fish feeds and fish production. Higher feed cost, is due to the high price for the animal protein ingredients used *viz* fishmeal, to prepare the fish feeds. Therefore, there is a great economic and environmental incentive to find less expensive protein sources to replace fishmeal in aqua-feeds. Therefore, an experiment was conducted to evaluate cassava leaf meal instead of fishmeal in platy fish diet. Young cassava leaves were collected, chopped and sun-dried to prepare cassava leaf meal. The fish feed was prepared with 0%, 5%, 10% and 15% replacement level of cassava leaf meal for fishmeal. A total of ninety six platy fish at the age of 21 days were the study population. Eight fish were used per replicate, and three replicates per treatment were allocated in a Completely Randomized Design (CRD). Feed was fed in *ad libitum* and proper water quality was maintained. The T_1 (5% cassava leaf meal) recorded highest body weight (0.31±0.03g) and the least (0.23±0.01g) was in T_3 (15% cassava leaf meal). The weight gain was greater ($p<0.05$) for T_1 (68.8±17.8%) than for T_0 (59.4±27.6%). There were no significant differences of total length and length gain of fish among the treatments. Highest SGR was obtained in T_0 (2.91±0.24%) and T_1 (2.87±0.13%). Best FCR (0.78±0.13) was obtained in T_1 diet. Food consumption increased as the level of cassava leaf meal increased from 0% to 10% of the diet. Results indicated that, growth performance and feed utilization values were significantly ($p<0.05$) higher in fish fed with diets containing 5% cassava leaf meal, where as lower performance was in fish fed with diets containing 15% cassava leaf meal. The current study shows that cassava leaf meal can replace fishmeal upto 10% substitution level without any advers effect on growth and food utilization performance.

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Effect of dietary replacement of fishmeal by meat meal made out of rejected chicken at slaughter house on the growth performance of koi (*Cyprinus carpio*)

W.S. Malinda Harsha Kumara

Because of declining global availability and increasing demand, fishmeal is a major contributor to the rising cost of fish feeds and fish production. Higher feed cost, is due to the high price for the animal protein ingredients used *viz* fishmeal, to prepare the fish feeds. Therefore, there is a great economic and environmentally sustainable incentive to find less expensive protein sources to replace fishmeal in feeds for aquaculture. Therefore a study was undertaken to investigate the suitability of using rejected chicken form slaughter house as a replacement protein source for expensive fishmeal in the diet of *Cyprinus carpio haematopterus*. Chicken meat was collected from "Crysbro" meat processing unit, Gampola and meat meal was prepared. The meat meal contained 70% protein, 19% lipid, 1% ash on dry weight basis. Four different diets (T_1= commercial koi carp pellet, T_2= imported fishmeal diets, T_3= meat meal diets and T_4= local fishmeal diets) were used to feed the fish as treatments. The experiment was done at the Nutrition Laboratory of the Department of Animal science, Faculty of Agriculture, Eastern University, Sri Lanka for six weeks. One hundred and twenty fry of *Cyprinus carpio haematopterus* (0.796 g/fry) were stocked in 12 glass tanks (experimental unit) at a density of 10 fry/tank. Each experimental unit was replicated three times. The experimental was conducted under Completely Randomized Design (CRD). Water quality parameters were within the acceptable range during the experimental period. The best growth was obtained on the diets with imported fishmeal, meat meal, and on the commercial diet (T_2>T_3>T_1). The T_2 recorded the highest final body weight (3.34±0.39 g) and the least (2.55±0.35 g) was in T_4 (local fishmeal). The weight gain was 2.54±0.34 g ($p<0.05$) higher on T_2 than on T_4 (1.74±0.36 g). There were no significant differences of survival rate, condition facter, initial standard length and length gain of fish among the treatments. Highest SGR was obtained on T_2 (6.05±0.80%) and T_3 (5.48±0.65%), and lowerst SGR was obtained on T_4 (4.15±0.86%). Best FCR (1.98±0.14) was obtained on T_3. Lowest feed cost was on T_3 (meatmeal diets) and highest feed cost shown on T_1 (koi carp pelet meal). Current study reveals that diet with chicken meat meal shows better growth parameters with lowest possible cost on *Cyprinus carpio haematopterus* than other diets.

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Effect of different dietary lipid sources on semen quality of village chicken

G.S.D. Jayawardhana

Reproductive performance of the poultry is directly linked with the production performance of the chicken where the management conditions are in the vital role. A sperm quality was determined by volume, concentration, motility and fertility. These parameters was influenced by dietary lipids. Therefore, this study was formulated on poultry to study the impacts of different dietary lipid sources on concentration, motility, viability and the weight gain of poultry. Study was conducted in Central poultry Research station, Located in Karadagolla in the Kandy District. Experiment was carried out using four treatments with different lipid sources sun flower oil, soya oil and coconut oil with five replicates. Processing and evaluation of the collected semen were conducted using ejaculation tubes to measure concentration (equipment), viability (equipment) and motility (equipment). Semen parameters was statically analyzed using a one way ANOVA. During the experimental period there wasn't any significant difference of viability and motility and concentration. Most of articles says significant differences of their experimental trial commenced after four weeks of experimental trial and said further experiment showed improvements of viability and motility. At the nature, the average of volume of semen per bird had not any significant at first week and third week. In the second week volume of semen showed the significant ($P<0.05$) difference in sunflower oil (1.29 ±0.03), soya oil (1.30 ±0.06) and coconut oil (1.42 ±0.05), this was comparatively higher than the normal feed. In first week experimental diets had the direct impact on the weight gain of bird. Highest (2.30 ± 0.49) and lowest (0.20 ± 0.20) weight gain was observed in coconut oil and normal feed respectively at the end of four weeks. Coconut oil feed showed the significantly ($P<0.05$) difference while comparing with the soya oil, sunflower oil and normal feed.

Supervised By: Dr. M. Pagthinathan
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Effect of somatic cell counts and the properties of yoghurt made from cow milk

S. Thushanthini

Somatic cells are an important component naturally present in milk, and somatic cell count (SCC) is used as an indicator of milk and dairy product quality. Yoghurt is the fermented dairy product obtained by lactic acid fermentation of milk. This study was conducted to evaluate the influence of SCC on the physicochemical properties, microbial analysis, and sensory evaluation of yoghurt. Milk was divided into four groups according to the range of SCC (**P1**: 3.6 × 10^5 cells/ml; **P2**: 4.5 × 10^5 cells/ml; **P3**: 5.4 × 10^5 cells/ml; **P4**: 7.2 × 10^5 cells/ml). The yoghurts made from different range of SCC were analyzed for chemical parameters (pH, titrable acidity, fat, protein, total sugar, reducing sugar, ash content, and dry matter), physical parameter (syneresis), sensory evaluation and microbial analysis on weeks 1, 2, 3 and 4 after production. There were no significant differences (p>0.05) in content of ash, dry matter, titrable acidity, pH, total sugar, reducing sugar and fat among the SCC ranges of milk. But, increase in total protein with increasing milk SCC. High content of total protein (3.62±0.01) was observed in 7.2 × 10^5 cells/ml SCC range of milk. At day one yoghurt made with 3.6 × 10^5 cells/ml SCC range shown high value of dry matter, fat, reducing sugar, total sugar and pH as (18.7±0.1%), (2.77±0.12%), (2.85±0.09%), (2.85±0.09%), (15.64±0.04%) and (4.49±0.01) respectively. Yoghurt made with 7.2 × 10^5 cells/ml SCC range shown high ash, total protein and titrable acidity as (1.05±0.03%), (3.91±0.6%) and (0.86±0.02%) respectively. During the storage period, ash, dry matter, pH, and titrable acidity, total sugar, reducing sugar, fat, and protein (p<0.05) were significantly differed with SCC range of yoghurt. Yoghurt made with 3.6 × 10^5 cells/ml SCC range shown high value of fat, reducing sugar, total sugar and pH (2.7±0.1%), (2.71±0.14%), (12.63±0.03%) and (4.43±0.01) respectively during first week of storage. Yoghurt made with 7.2 × 10^5 cells/ml SCC range shown high value of total protein and titrable acidity as (3.7±0.1%) and (1.18±0.03%) respectively during fourth week of storage. Syneresis of yoghurt was increased with increasing SCC range. Syneresis was high (44.32±0.08%) in yoghurt made with 7.2 × 10^5 cells/ml SCC range after 2 hours of analysis. There is a significant difference (p<0.05) was observed between SCC range and sensory attributes (texture, taste, colour, flavour and overall acceptability) of yoghurt evaluated during 4 weeks of storage period. All sensory attributes of yoghurt were decreased with increasing SCC range during storage period. Bacterial colony count of yoghurt was

increased with increasing SCC range. The maximum amount of bacteria [(1.4±0.67) × 10^6 CFU] was observed on 7.2 × 10^5cells/ml SCC range of yoghurt at 2 weeks of storage. The overall results indicate that higher milk SCC (7.2 x 10^5 cells/ml) has a negative effect on the physical, chemical and organoleptic quality of yoghurt than low SCC milk (3.6 x 10^5 cells/ml).

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Evaluation of physio-chemical properties of probiotic sausages

H. Rinoza Banu

Probiotic food products are very popular on domestic and international markets. The application of probiotic in dairy products is quite frequent, while their application in meat products is still being explored. Six types of sausages were develop as indicating beef sausage, beefwith probioticsausage, mutton sausage, muttonwith probiotic sausage, .chicken sausage and. chicken with probiotic sausage. Through 30 days of fermented sausage ripening, the survival of probiotic bacteria, the changes of starter bacteria counts, as well as thephysical properties, chemical composition, pH values and sensory evaluation were examined. There were significant differences ($p < 0.05$) observed in dry matter content, ash, and weight loss, water holding capacity, pH, titrable acidity, fat and protein among all types of sausages. At day one High amount of dry matter and ash content was observed in beef sausages and probiotic chicken sausage (59.51±2.8) and (0.98±0.01) respectively. Hightitrableacity and low pH value were observed in Probiotic chicken sausages (1.06±0.05) and (5.37±0.04) respectively. During the storage period, ash, dry matter, pH, and titrable acidity, weight loss, water holding capacity, fat, and protein ($p < 0.05$) were significantly differed among all types of sausages.High amount of titrable acidity and lowet pH value were observed in probiotic chicken sausages (1.22 ± 0.02) and (5.16 ± 0.01) respectively. Beef sausages showed high amount of fat, protein and dry matter content, (10.16 ± 0.35),(24.4 ± 0.00), and (52.2 ± 0.60) respectively. During the first period of ripening, probiotic counts were 10^8cfug^{-1}, after which they increased to the level of 10^9cfug^{-1} and remained there until the end of storage. Probiotic bacteria counts were within the range typical for fermented sausages. The physical, chemical composition and the pH values of fermented sausages produced with probiotic bacteria were significantly differ from the control variant.Sensory evaluation has shown that all variants of fermented sausages had an acceptable sensory quality.Based on thesurvival of probiotic bacteria during 30 days of fermented sausage ripening, it can be concluded that probiotic can besuccessfully used in the production of fermented sausages, without affecting the sensory quality of the sausage.

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Investigate the factors affecting the semen quality and fertility of local chicken cockerel

S.S. Chathuranga

Semen evaluation of the village chicken play vital role in poultry section and also it is directly linked with the production performance of the village chicken. A semen quality was determined by volume, concentration, viability (dead cells and live cells), motility fertility, hatchability and post hatchability performance. These parameters was influenced by age of the birds, environmental conditions, nutrition factors and genetic factors. Therefore, this study was formulated on village chicken to study the effect of age and environmental factors on seman quality such as semen volume, concentration, motility, viability, hatchability and etc. of the birds. Study was conducted in Central poultry Research station, located in Karandagolla in the Kandy District. Experiment was carried out using three treatments with different age groups of cockerels and hens and each contained three replicates. Processing and evaluation of the collected semen were conducted using ejaculation tubes to measure concentration (equipment), viability (equipment) and motility (equipment). Semen parameters was statically analyzed using a one way ANOVA design. In this study, there were no significant difference on semen volume and semen concentration with age of birds. Semen volume value ranged between 1.13ml-1.27ml and semen concentration value ranged between 0.16-0.27. There were significant difference on live cells and dead cells count of the semen. The highest value (6.33±1.33) shows by age of 48 weeks birds and lower value (4.00±0.577) shows by age of 72 weeks birds. The egg weight of the birds were not showed significant difference and egg weight ranged between 50 g-52.5 g. Number of chicks in different age groups of birds not showed significant difference between 24 weeks and 48 weeks age groups but 72 weeks age group was showed higher significant difference than other age groups. In hatchability, only significant difference showed by batch number 1 age of 24 weeks and batch number 2 at age of 72 weeks of the birds. It was ranged between 82%-100%. Batch number 4 shows significant difference on post hatchability performance. Thus other batches with difference age groups were not showed significant difference. Fertility of eggs were showed significant difference on batch number 1, 2, and 3. The results of motility revealed that there were difference activity on sperm of village chickens. Therefore age of

24 weeks showed non progressively motile action while age of 48 weeks and 72 weeks showed progressively motile action. According to research findings, the effects of environmental factors to the semen volume may be affected by temperature, rainfall and humidity at the difference age groups of the birds. But there were no effect of environmental factors to the semen volume during this study due to less fluctuation of environmental factors and higher tolerance of the birds to the environmental factors.

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Present trends in livestock feeding in Ampara District

A.G. Ahamed Fayas

The study was undertaken to determine the present trends in livestock feeding in Ampara district during the period from October 2015 to February 2016. Sammanthurai, Karaitivu, Dehiyathakandy were selected for this survey. This survey covered fifty farmers in each study area consisting of total 150 farmers. A structured questionnaire, group discussion, plant biomass sampling, literature and survey were done to generate data on farmer's feed sourcing and feeding strategies. Stratified random sampling method was used to select the farmers in this survey. The study revealed that almost all the study areas had more than 10 years of experienced farmers in livestock sector (Average 60%), which is sufficient for better management and care for more livestock production. Majority of farmers in whole study area were small holders (60%). Only (average 7%) few farmers were practicing intensive farming system in the whole study area, Most of the farmers (average 59%) were practicing extensive and (34%) semi intensive rearing system in whole study area. Most of the farmers reported that major constraints (87%) in farm was high cost for concentrate feeds followed by low price for milk, lack of grasses and grazing land, lack of credit facilities, and to lack of water. Paddy straw, rice bran, tree leaves (Gliricidia, Ipil Ipil), kitchen wastes, crop residue were major available feed in whole study area. Paddy straw was used by more than 80% of the farmers in each study area. The conducive climatic conditions and paddy cultivation in the region are the acceptable merits to the feed industry. Lack of pasture and fodder production, increasing cost for concentrate feeds, less adoption of improved management practices and lack of knowledge about conserved feed material preparation are the major limitations prevailing in the study area. Kitchen wastes were used by farmers regularly, such as coconut scrap, vegetable wastes, fish wastes, meat wastes, which are major component of kitchen wastes as a livestock feed. Among the milling by products rice bran mostly used by farmers in each study area. The prices of straw and rice bran were Rs.2600 per bundle (four wheel tractor load) and Rs.28 per kg respectively.

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Preservation of functional and quality properties of chicken eggs during the cold storage

Abdul Razak Mufasa

The chicken egg receives maximum importance due to its unique taste, high nutritive value and persistent demand in the world market. Chicken egg production is concentrated in Western province in Sri Lanka. However, currently chicken egg production becomes as an important industry in Ampara district. With the increased production of eggs, there is a need to preserve them for long-term marketing with ideal storage conditions. In this context, a study was conducted in four chicken farms in Nintavour DS Division to analyze the changes in functional and quality properties of chicken eggs during the cold storage. The research was carried out in four types of chicken breeds *viz.* Shaver White, Bovans White, Hyline White, and Hyline Brown, with the age of 25 to 30 weeks old. Averagely 50 eggs from each breed was randomly collected and stored at 10 ^{o}C in an incubator. The research was carried out for 35 days. Three stored eggs from each group were randomly collected every week and analysed for quality changes. Five stored eggs from each group were collected weekly for the analysis of functional properties. The data was analyzed using SAS 9.1 statistical software. The study revealed that quality parameters of egg were maintained within the acceptable range throughout the storage period. The respective mean values of functional and quality properties of the chicken eggs were: egg weight, 61.4 ±2.3 g; shape index, 71.8±1.5; shell thickness, 0.7±0.03; shell ratio, 11.4±0.8; yolk index, 29.9±2.5; yolk ratio, 30.0±1.3; yolk color, 4.0±0.0; albumin index, 8.3±1.6; yolk albumin ratio, 0.5±0.01; shell index, 10.7±0.5; haugh unit, 102.2±4.3; yolk pH, 6.5±0.1; albumin pH, 8.5±0.1; specific gravity, 1.4±0.1; foaming capacity, 48.1±1.1 and emulsification, 4.5±0.1. There was different ($P<0.05$) in functional properties and quality properties in chicken eggs breeds during the cold storage. Shaver, Bovans and Hyline White are more suitable to store at 10 ^{o}C for five weeks than Hyline Brown.

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Quantitative feed restriction on the performance of broiler chickens

D.M.N.D. Dissanayake

Broiler meat is the most consumed meat in Sri Lanka as an animal protein source. However the cost of production of broiler is high due to its higher feed cost. This study was conducted to evaluate the effect of quantitative feed restriction on the performance of broiler chickens. A total of 120, day-old broiler chicks were randomly allocated into four treatment groups such as 100% diet, according to the recommendation of feed act by Department of Animal Production and Health, as control treatment (T1), 90% of the control diet (T2), 80% of the control diet (T3) and 70% of the control diet (T4). All treatments were replicated thrice with 10 birds per replicate in a Completely Randomized Design (CRD). Broiler chickens were fed broiler starter diet from day 1 to day 21 and broiler finisher diet from day 22 to day 42. Fresh drinking water was provided *ad libitum* and proper litter management, sanitation and vaccination were adopted. The results related to the growth performance revealed that the body weight gain in the birds fed with 90% diet was significantly higher than the birds fed with control diet (100%) during finisher and overall phases and vice-versa during starter period. The feed intakes of birds were significantly decreased with the severity of feed restriction during all periods (0-21d, 22-42d and 0-42d). However, a significantly lowest overall Feed Conversion Ratio was reported in the birds fed with 70% diet (T4).The results related to the relative organ weights of broiler chickens revealed that the birds in control treatment had significantly higher relative liver and lung weights while they had significantly lower relative heart weight when compared to others. The immune organ spleen was significantly increased in the birds fed with 90% diet whereas bursa was significantly increased in the birds fed with 80% and 70% diet when compared to the control. Therefore, it could be concluded that feed restriction improves the immunity of broiler chickens by increasing the weights of immune organs. Moreover, the relative gizzard weight was significantly increased in the birds fed with 70% diet. Results showed that cost of feed (351.36 ± 0.00) significantly higher with 100% diet (Control). However, income from broilers (616.0±14.6) was significantly higher from the birds fed 90% diet. In addition, the results indicated that, profit from the feed restricted birds were significantly higher than the control where there were no difference between the restricted groups.

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Assessment of genetic diversity in selected *capsicum* spp. cultivated in Sri Lanka

Thilini Madhushani Kumarasingha

Simple Sequence Repeat (SSR) markers are useful tools for evaluating genetic diversity and DNA fingerprinting. The purpose of this study was to evaluate the genetic diversity within 10 chilli accessions by using microsatellite markers and morphological markers. Over the last few decades, the use of molecular markers has played an increasing role in chilli breeding and genetics. This research was conducted at the Division of Plant Biotechnology, Field Crops Research and Development Institute (FCRDI), Mahailluppallama, Anuradhapura. A fingerprint was developed in this study for ten chilli accessions using six Simple Sequence Repeat primers. DNA was extracted using modified CTAB protocol. Polyacrylamide gel electrophoresis was done to identify polymorphism in different alleles of polymerase chain reaction products. Amplified products varied from 140 bp to 290 bp. The molecular data were subjected to statistical analysis using PopGene. S2 software and genetic distances were calculated. The differences and relationships of ten chilli accessions were identified from the clusters in the dendrogram. Molecular cluster analysis indicated two distinct clusters and many sub clusters. The first group contained Hen miris, MICH-3, ICPN-18-7 line, Arunalu, MI-2 and MI green. The second group contains Waraniya purple, Hot beauty, Purple Nai Miris (*C. chinense*) and Acc.No.11642 (*C. frutescent*). This study revealed the genetic similarity between the varieties of Arunalu and MI-2. The most distant phylogenetic relationship was observed between Hot beauty and MICH-3 followed by MICH-3 and Waraniya Purple. MICH-3 is a variety developed by the Field Crops Research and Development Institute (FCRDI), Mahailuppallama using parents (MI-1 and Wonder hot). Hot beauty and Waraniya Purple have been developed through selections from local landraces. Purple Nai Miris (*C. chinense*) and Acc.No.11642 (*C. frutescens*) both formed another subcluster with more distance. These accessions show genetic difference from the improved varieties. According to morphological classification, Most of the accessions had green colour stems and Intermediate type of plant habits. White colour corolla and pendent type of flower position were common among the accessions. Higher genetic variability within varieties and significant difference between varieties indicated rich genetic material of a species. Thus, microsatellite markers offer a potential, simple, rapid and reliable DNA fingerprinting method to evaluate genetic variation among the chilli germplasm. The findings of the present study have the potential

applications in future breeding programme for the genetic improvement of chilli.

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Development of a somatic embryogenesis protocol for tea (*Camellia sinensis* L.) O. Kuntze)

A. Sivapriyadharshini

Somatic embryogenesis is an alternative method to resolve constrains in conventional crop improvement in tea **(***Camellia sinensis* L. O. Kuntze). Hence, the present study was conducted with the objective of developing a viable somatic embryogenic protocol for tea. For induction of somatic embryos, three types of explants (third leaf, cotyledons -mature and immature) and leaf callus (2nd and 3rd sub cultures) of TRI2024 and TRI2043 cultivars were inoculated in MS media with different hormone combinations [Leaf in 2 mg/l BAP + 3 mg/l NAA; Cotyledon in 2 mg/l BAP + 0.2 mg/l NAA; Leaf callus in 2 mg/l BAP + 3 mg/l NAA and 2 mg/l BAP + 3.5 mg/l NAA. MS media supplemented with two growth regulator combinations (2 mg/l BAP + 1 mg/l NAAand3 mg/l BAP + 0.1 mg/l NAA) were tested for regeneration of somatic embryos derived from cotyledon explants. Friable callus were initially obtained from TRI2024 in 2 mg/l BAP + 3 mg/l NAA. Somatic embryos were initially observed in mature cotyledons of TRI2024 in 2 mg/l BAP + 0.2 mg/l NAA. All growth stages as the globular, heart, torpedo and cotyledonary stages were obtained from somatic embryos and highest percentage (40%) of complete healthy plantlets were obtained from somatic embryos in 2 mg/l BAP + 0.2 mg/l NAA of TRI2024 while somatic embryoids were observed in 2 mg/l BAP + 3 mg/l NAA of TRI2043. Significantly highest relative growth rate (92.21%) was observed from leaf callus in 2 mg/l BAP + 3.5 mg/l NAA of TRI2024 when, using 2nd subculture (Mean value 83.89). 2nd subculture of leaf callus in MS medium with 2 mg/l BAP + 3 mg/l NAA is better to induce somatic embryos. MS medium with 3 mg/l BAP + 0.1 mg/l NAA was best for somatic embryo regeneration.

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Effect of adenine sulphate and D-biotin on the *in vitro shoot* regeneration of bitter gourd (*Memordica charantia* L.)

J.A.D.C Kawshalya

The study was conducted under three experiments. First experiment was carried out to select the most responsive explant through callus stage to establish initial culture. Four different explants, (cotyledon, Cotyledon node, leaf, hypocotyl) from *in vitro* grown seedlings were cultured on MS medium fortified with 1 mgl^{-1} BAP and 0.2 mgl^{-1} NAA. Cotyledon was the most responsive explant which exhibited quick callus initiation (11.3 days after culture), superior callus formation % (97.2%) and highest callus weight (0.657g). Second experiment was conducted to determine the effect of various concentrations of adenine sulphate (AS) on callus induction and shoot regeneration of bitter gourd. Cotyledon explants were cultured on modified MS medium supplemented with 1 mgl^{-1} BAP, 0.2 mgl^{-1} NAA and also different concentrations (0, 20, 40 and 60 mgl^{-1}) of AS. The best medium for callus formation was from modified MS medium supplemented with 1 mgl^{-1}BAP, 0.2 mgl^{-1} NAA and 60 mgl^{-1} AS. Callus derived from such medium was showed best positive response for shoot regeneration after subcultured on MS medium contained 2 mgl^{-1}BAP and 0.2 mgl^{-1} NAA. Regenerated shoots were multiplied on MS medium supplemented with 3 mgl^{-1} BAP. Eventually *in vitro* rooting was achieved on MS medium included 1 mgl^{-1} IBA. Further, experiment was carried out to study the effect of D- biotin on cotyledon explant. Cotyledons were cultured on MS medium fortified with growth regulators (BAP and NAA) alone and in combination with D-biotin. It was obvious that D- biotin introduced into the composition of the culture medium has a beneficial effect on the callogenesis, in association with BAP and NAA. Specifically 2 mgl^{-1} BAP, 0.2 mgl^{-1} NAA and 1 mgl^{-1} D- biotin, obtained high callus weight (1.856 g) and quick callus initiation (7.6 days after culture). D- biotin played an important role in callogenesis when compared to culture medium without D- biotin.

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Effect of chloromequat-chloride application on growth and yield of capsicum (*Capsicum annuum* L.) grown in open field

D.K.U.S. Deweniguru

Capsicum (*Capsicum annuum L.*) is a tropical plant, which belongs to family solanaceae and ideally suited to hot and humid conditions. Capsicum has extent of 15439 ha with 72034 Mt of produced quantity in Sri Lanka during both *Yala* and *Maha* seasons in year 2014. Demand of capsicum is high in Sri Lanka, because production of capsicum is low due to pest and diseases, poor post harvest knowledge and post harvest facilities and unfavorable environmental conditions such as high or low rainfall, temperature, relative humidity. Flower and fruit drop also a reason for yield reduction caused by physiological and hormonal imbalance in the plants particularly under unfavorable environments, such as extremes of temperature or too low or high temperatures. Chloromequat chloride is one of growth regulator which has the ability to reduce fruit and flower drop and increase the yield. Therefore, an experiment was carried out to determine the effect of Chloromequat chloride on growth and yield of the capsicum at Horticultural Crop Research and Development Institute at Gannoruwa from 2015 October to 2016 February. Capsicum *var* CA-8 was used in this study. Chloromequat chloride as a foliar spray at different times from transplanting of capsicum plants at the rate 14ml/16L. Treatments were, T_1 as water spray at one, two and five weeks after transplanting, T_2, T_3, T_4 and T_5 were application of Chloromequat chloride at one, two, five weeks after transplanting and one, two, five week after transplanting respectively. Treatments were arranged in Randomized Complete Block design with three replicates. Plant height, chlorophyll content, days taken to first flowering and 50% flowering, number of days taken to fruit initiation, canopy width, number of flowers per branches, number of pods per plant, average pod width, average pod length, average thickness of pods, marketable yield, non-marketable and total yield were measured. There was no significant difference ($P > 0.05$) among tested treatments in plant height and chlorophyll content. Plant growth rate was increased in T_5 (application of Chloromequat chloride at one, two, five weeks after transplanting). All treatments had first flower at 34 days after transplanting. According to the chi square values, no significant difference ($P > 0.05$) among tested treatments in number of days taken to 50% flowering, number of days taken to first fruit and the number of flowers per branch. Also there was no

significant differences ($P > 0.05$) among tested treatments in average canopy width and number of pods per plant. Further, marketable, non marketable and total yield of capsicum were statistically same in all tested treatments. Therefore, present study concluded that application of chloromequat chloride at different time intervals in different growth stages did not show positive impact on growth and yield of capsicum grown in open field.

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Effect of different rates of nitrogen and phosphorous on growth and nodulation of *Glycine max* (L.)

V.J. Yatawatte

Soybean is an important crop worldwide as a good source of protein and vegetable oil. Cultivation of soybean is very low in the Batticaloa district due to its poor yield. It may be increased using more amounts of fertilizers, however, it is not economical for poor farmers and also not favorable for the environment. Finding of suitable fertilizer combination is very important in this situation. Therefore an experiment was conducted to study the effect of different rates of nitrogen and phosphorous on the nodulation and growth of soybean and also to find out the optimum levels of nitrogen (N) and phosphorous (P) for maximum nodulation and growth of soybean. The pot experiment was conducted under a rain shelter in Agro Technology Park, Eastern University, Sri Lanka. The experimental design was Complete Randomized Design (CRD) with four replicates. Different fertilizer combinations were used as treatments such as T1 – 30N:150P:75K: kg/ha, T2 – 70N:150P:75K: kg/ha, T3 (control) – 50N:150P:75K: kg/ha, T4 – 50N:125P:75K: kg/ha and T5 – 50N:175P:75K: kg/ha. Measurements were taken and data were statistically analyzed. The results revealed that there were significant ($p<0.05$) differences among the treatments on plant height, number of leaves, leaf area, number of pods, plant fresh and dry biomass, plant nitrogen content, number of nodules and number of effective nodules. Plant height and number of leaves were not significantly affected from different fertilizer combinations at initial stages. It was observed that T4 (50N:125P:75K: kg/ha) showed significant increment in growth and nodulation of soybean. Therefore application of fertilizer combination with reduced amount of phosphorous fertilizer could be used to get maximum growth and nodulation of soybean in sandy regosols in Batticaloa district.

Effect of different soil amendments on growth and yield of rice (*Oryza sativa* L.) grown in saline soil

P. Ilakkiya

Rice (*Oryza sativa*) is widely consumed staple food in many part of the world. Growth and yield of rice was adversely affected by salinity in past years. There is lack of researches conducted about reclamation of saline soil by adding of amendments. Therefore the aim of this study was to investigate the effect ofsoil amendments on growth and yield of rice grown in saline soil. A pot experiment conducted during *maha* season during November 2015 to February 2016 in the crop farm, Eastern university of Sri Lanka. The experiment was complete randomized design (CRD) with 5 replications. Soil was artificially salinized by NaCl solution to above the EC 4 dSm^{-1}. Totally 25 pots examined with 4 type of soil amendments such as compost (1t/ha), green manure (1t/ha) and gypsum (0.08t/ha), ground lime stone (0.03t/ha) were used and no application of soil amendment considered as a control. Variety Bg300 was used in the experiment. All the agronomical practices followed as recommended by department of agriculture. Growth and yield parameters were taken by destructive sampling method. In this experiment, Gliciridia amended soil had highest plant height (84.76cm), Leaf area per plant **(**769.24cm^2), dry weight per plant (2.4g), highest Panicle length (25.6cm),Total spikelet per plant (374), Hundred seed weight per plant (2.36g) and Yield (1.5Ton/ha).Further, Gypsum amended saline soil gave highest Number of tillers per plant (7). It can beconcluded gliciridia is suitable amendment that can be applied for saline soil to increase the growth and yield performance of rice (variety Bg 300).

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Effects of graded shade levels on the growth and quality of *Cordyline fruiticosa* variety 'Purple Compacta' in Batticaloa District

M. Krishnakanth

Dryzone has the potential for future agricultural development. Information from this research could be utilized to develop an efficient shade management practice for the cultivation of *Cordyline fruticosa* in the Batticaloa district. *C. fruticosa* is a popular foliage plant and it has high demand in the export market. Shade influences the growth and quality of ornamental foliage plants. Therefore, proper shade level is necessary in nurseries where, *C. fruiticosa* plants are being grown. An experiment was conducted to determine the optimum shade level for *C. fruticosa* variety 'Purple Compacta' cultivation at the Batticaloa district from October 2015 to February 2016. The experimental location was Crop Farm, Eastern University, Sri Lanka. Experiment was arranged in a completely randomized design (CRD) with three replications. The treatments consisted of five shade levels viz. 0, 50%, 60%, 70% and 80%. Commercial black polypropylene shade houses with different shade levels were used to grow treatment plants. Agronomic practices were followed uniformly for all treatments. Plant height, leaf area, number of leaves and plant biomass were measured at monthly interval and quality of cuttings was assessed at the end of experiment. Analysis of variance was performed to determine significant difference among treatments ($p<0.05$). Results revealed that plant height, leaf area and plant biomass were significantly ($p < 0.05$) higher in plants grown at 50% shade level. Allocation of biomass for root, shoot and leaves was also nearly equal in plants grown at 50% shade level. In quality assessment, plants subjected to 50% shade level obtained significantly ($p<0.05$) highest scores. In 50 % shade level, *C. fruticosa*. 'Purple Compacta'plants would have received optimum amount of light for better performance. It could be the reason for highest performance of these plants at this shade level. Plants performance was lower in other treatments. From this experiment, it could be stated that, 50% shade level is suitable for growing *C. fruticosa* 'Purple Compacta' in the Batticaloa district as the growth and quality of plants were higher.

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Effects of inorganic and organic nutrient sources on growth and nodulation of *Glycine max* (L.)

L.N. Mohottige

Chemical fertilizers and pesticides are becoming severe problem today because of excessive usage over a long period of time. This leads to adverse toxic effects on the production potential of the land and the ultimate consumers of the agricultural products. Organic nutrient sources are one of good alternative which makes healthy food, healthy soils with ample amount of effective microorganisms, healthy plants and environments a priority along with crop productivity. This experiment was conducted with three different liquid organic nutrient sources with inorganic control to investigate crop growth and nodulation of Soybean (G*lycine max)* and comparison of the performances of different nutrient sources. This experiment was conducted as pot experiment under rain shelter from November to December for five weeks at agro technology park Eastern University, Sri Lanka. Four treatment with ten replicates were arranged in complete randomized design. The treatment compositions were, T1- application of Jeewamirtha once week, T2- application of Panchagaveya once a week, T3- application of Amuthakarisal once a week and T4- inorganic fertilizer application based on the recommendation of Department of Agriculture. The measured parameters during the research were plant height, numbers of leaves, leaf area, number of flowers, shoot and root biomass, nodules number, and number of effective nodules, and nodules weight of the plant. It was found that there were significant differences among the treatment on tested parameter. There was no any significant differences among the treatments on plant height, leaves number at initial stages. It was observed that application of Jeewamirtha giving the highest result on growth parameters and nodulation of G*lycine max* compared to all other treatments. The results obtained from application of Panchagavya, Amuthakaraisal and inorganic fertilizer was given approximately same result on most of parameter except nodulation and number of flowers per plant. Hence application of Jeewamirtha increases the growth and nodulation of *Glycine max in comparison to* other nutrient sources. Therefore, application of Jeewamirtha will increase the production of *Glycine max* in an environmental friendly and cost effective manner.

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Effect of liquid organic fertilizer (Panchagavya) on the growth performance of hybrid and local *Zea mays* L. varieties in comparison to inorganic fertilizer

S. Lahindhiri

Uses of chemicals lead to adverse environmental effect, agricultural and health consequences. Maize has been cultivated by the traditional farmers with increased application of synthetic fertilizers. Current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable agriculture. In this regard, a pot experiment was carried out at Agro Technology Park, Faculty of Agriculture, Eastern University Sri Lanka, to find out the effect of liquid organic fertilizer (Panchagavya) on the growth performance of Hybrid and Local maize varieties in comparison to inorganic fertilizer. It was a factorial experiment distributed in a Complete Randomized Design (CRD) with three replications. "Pacific" and "Ruwan" varieties were evaluated under three different application frequencies of Panchagavya and recommended dosage of inorganic fertilizer for growth characters such as plant height, number of leaves, leaf area and biomass. Measurements were taken at six weeks after planting and data were analysed statistically. Results showed that interaction between varieties and application frequency of Panchagavya were significantly ($p<0.05$) different. In Panchagavya application, maximum results for plant height, number of leaves, leaf area and biomass were obtained from once a week application. While, minimum results were obtained from once in three weeks application in both maize varieties. The results also revealed that once a week application is more suitable than the other application frequency in both maize varieties. Even once a week application of tested parameters was smaller than the control (Inorganic Recommended Level) but, it was eco-friendly and low health problems. Cost analysis of this experiment showed that once a week application of Panchagavya in Pacific is most suitable for farmer to get high yield with lower cost of production in comparison with inorganic fertilizer.

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Effect of salt stress on *in vitro* organogenesis of tomato (*Lycopersicon esculentum* mill.)

M.M.A. Nethmini Shanika

This study was aimed to determine the effect of salt stress on *in vitro* organogenesis of tomato KC-1 cultivar. First experiment was done to observe *in vitro* response of cotyledons and cotyledon nodes with auxiliary bud portion derived from 12 days old *in vitro* grown seedlings. Various concentrations of plant growth regulators were used for the experiment. MS media fortified with 1.0 mg/l BAP and 0.2 mg/l NAA exhibited better *in vitro* response and shoot formation for both explants after 4 weeks of culture. Responses to salt stress of tomato were studied during the germination and early growth of the tomato KC-1 under controlled environment. The results revealed that by increasing salinity, germination percentage was decreased. On 80 mM of salinity level, germination reached to minimum value (17.8%). Other measured characteristics such as mortality percentage, shoot and root lengths, dry and fresh weights of shoots and roots, Relative water content and salinity level of first leaves were affected significantly after 12 days of seeding. Response of cotyledon callus of tomato KC-1 under salt stress was also studied for *in vitro* organogenesis. This experiment was carried out in the completely randomized design with 4 treatments and 3 replications. Seedlings using *in vitro* amplification method, they were cultured for callus induction on MS medium containing 1.0 mg/l BAP, 1.0 mg/l NAA or 0.2 mg/l NAA. Then the produced calli were placed under salt stress from different concentrations of NaCl (0, 20, 40 and 60 mM) after 2 weeks of culture on MS medium containing 1.0 mg/l BAP and 1.0 mg/l NAA. In this experiment, colour of callus, wet weight, dry weight, water content and chlorophyll content of callus were studied after 4 weeks of culture under salt stress. The results revealed that meaningful differences were existed all studied characters. The callus placed on 60 mM NaCl level was highly affected with comparing control. After that calli were transferred to MS media containing 2.0 mg/l BAP and 0.2 mg/l NAA. Somatic embryogenesis from the transferred calli were observed on that media on control (0 mM) and 20 mM salt stressed calli and somatic embryos were germinated within 4-5 weeks of culture.

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Effect of soil compaction on growth and yield of cowpea (*Vignaunguiculata* (L.) Walp)

G. Thadshaini

Soil compaction is a worldwide problem in modern agriculture and has been recognized as the main form of soil degradation.Soil compaction may increase soil strength and compacted soil layers can affect growth and yield of crops.The aim of this research was to investigate the effect of soil compaction on growth and yield of cowpea(*Vignaunguiculata* (L.) Walp).This experiment was conducted during*maha*season in 2015 at crop farm, Eastern university of Srilanka. This experiment was a pot experiment and there were four treatments based on different bulk density levels ($1.33gcm^{-3}$, $1.60gcm^{-3}$, $1.80gcm^{-3}$, and $2.00gcm^{-3}$)arranged in a completely randomized design (CRD) with nine replicates.Wijaya,a variety of Cowpea was used for the experiment. All agronomic practices were followed as recommended by department of agriculture.Finally growth and yield parameters were taken by destructive sampling method. The results revealed that soil compactionhas significantly influenced on growth and yield of cowpea andthe highest growth and yield parameters were recorded at treatment $1.33gcm^{-3}$(control) among all treatments and there was a strong negative correlation between these parameters and level of soil compaction. The lowest yield (37.10tons/ha) was recorded at soil compaction level 2.00 g cm^{-3}, while the maximum yield (70.31tons/ha) was obtained at soil compaction level 1.33 g cm^{-3}.It can be concluded fromthe result of this study that significant adverse effects of soil compaction on growth and yield of cowpea was well noticed.

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Influence of different shade levels on the growth and quality of *Polyscias balfouriana* Variety 'Marginata' in the Batticaloa District

R. Thanusha

Polycias baulfouria variety 'Marginata' is an ornamental foliage shrub with glossy green coloured leaves with white margins.The morphology of the leaves adds value for its quality in the export market. Light intensity greatly influences the amount of variegation in these plants. An experiment was carried out to evaluate the effects of graded shade levels on the growth and quality of *Polycias baulfouria* variety 'Marginata', in the Batticaloa district during the period of October 2015 to February 2016. The experiment was arranged in a completely randomized design with three replications. The experimental location was crop farm, Eastern University, Sri Lanka. Graded level of shades were defined as treatments viz. Control (T1), 50% (T2), 60% (T3), 70% (T4), and 80% (T5), of shade levels. Shade houses were constructed using commercial nylon nets of different shade level. Rooted, uniform cuttings of were used as planting materials. Agronomic practices were followed uniformly for all treatments. Plant height, leaf area, number of leaves and plant biomass were measured at monthly interval and quality of cuttings was assessed at the end of experiment. Analysis of Variance was performed to determine significant difference among treatments ($p< 0.05$). Plants provided with 50% shading showed significantly ($p<0.05$) better performance in measured growth parameters viz. plant height, plant biomass and biomass partitioning, while the lowest performance was observed in plants from 80% (T5) shading (lower irradiation) and open field (higher irradiation) condition (T1) . In quality assessment, plants subjected to 50% shade received significantly highest score. Plants grown at 50 % shade level would have received optimum amount of irradiation in this experiment. Therefore, it could be concluded that, 50% shade level is suitable for growing *Polycias baulfouria* variety 'Marginata' plants in the Batticaloa district as the growth and quality of plants varieties were in export standards.

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Yield comparison of lettuce *(Lactuca sativa L.)* grown in hydroponics using fish effluents and inorganic fertilizer

R.M.U. Rathnayaka

Aquaponics, the integration of aquaculture and hydroponic crop production represents a more environmental friendly and energy efficient method of production than each method practiced in isolation. The food insecurity situation with respect to Sri Lanka is illustrated by the fact that, worst malnutrition status is observed. Aquaponics, as a closed loop system consisting of hydroponics and aquaculture elements, can contribute towards these problems. But Sri Lankan Agricultural sector has not yet initiated Aquaponics. Therefore this experiment was conducted to compare yield of lettuce grown in hydroponics using fish effluents and inorganic fertilizer. The experiment was arranged in a Complete Randomized Design (CRD) with five treatments (Water, Albert's solution, Catla waste water, Common carp waste water and Tilapia waste water) and four replications. Plant height , Canopy diameter, Number of leaves ,Root length ,Leaf fresh weight , Leaf dry weight ,Root fresh weight, Root dry weight and Total yield were measured as plant growth measurements. Initial biomass/Fish, Final biomass/Fish, Initial stocking density and Final stocking density were measured as fish growth measurements. The result demonstrated that Albert's solution treated plants showed highest yield performance compared to the other nutrient solutions treated plants followed by higher yield obtained from waste water from Tilapia tank. Fish water solution did not fulfill the nutrient requirement due to fingerling stage of fish. Therefore, it could be concluded that higher yield was obtained in Albert's solution. While, selecting suitable age stage of fish and quality of feed can be expect to get higher yield like as in Albert's solution.

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